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Good Wiring Practice

Revised Regulations

AS the tenth edition of the Regulations for the Electrical Equipment of Buildings is now nearly five years old and no amendments of its provisions have been made since 1935 (and those published then were not particularly weighty), the issue of a new edition by the Institution of Electrical Engineers is to be welcomed. The eleventh edition is a well drawn-up document and bears every evidence of deep thinking as well as practical knowledge of the subject—as is, indeed, only to be expected from a glance at the names of the members of the Wiring Regulations Committee presided over by Mr. P. V. Hunter.

While following the much-improved general arrangement introduced in the previous edition, the Committee has taken the opportunity to polish the drafting and to simplify the wording and in many ways to make its recommendations more definite, while a reduction of about 20 per cent. in the total number of Regulations can in itself be considered a good thing. A particularly helpful feature, and one that might well be carried still further in future editions, is the greater use of explanatory notes at the end of paragraphs.

Apparatus and Cables

With a view to making each of the thirteen main sections as self-contained as possible there has been some justifiable repetition, but, on the other hand, it is distinctly better to have avoided the continual references to Section 13 formerly contained in the other sections by inserting in the opening General Section a new clause requiring that the design and construction of all apparatus and cables shall comply with the requirements of the section. If the points common to the installation of the various classes of cables could have been grouped similarly in an omnibus clause further space would have been saved.

Section 13 has itself been reduced in dimensions and has been shorn of much of its not always interesting detail by substituting for the latter a list of the relevant B.S. Specifications—a change that has been made possible by the increase in their number during recent years. The result, however, is to put upon the installation engineer the onus of procuring and wading through all such B.S.S., unless he prefers to take the easier course of dealing only with thoroughly reliable manufacturers!

In the list of B.S.S. the Regulations are more than up to date, as they mention specifications as yet unpublished. One of these relates to earth-leakage trips, about which some advance information was given by Mr. T. C. Gilbert (who first described Continental practice in our columns several years ago) at the E.C.A. Conference last week.

Voltage and not milliamps. is now logically recognised as providing the criterion for performance of this appliance, the installation of which is, moreover, positively required unless exemption is permissible on defined conditions. The use of all-insulated apparatus is strongly recommended.

Installation Inspection

Another pleasing feature is the recommendation that installations shall be inspected at intervals of not more than five years. Certificates for that purpose would be signed by a "competent person" who, a note states, should preferably be a chartered electrical engineer, a member of the E.C.A. or of the E.C.A. of Scotland, or a registered contractor. Such qualifications are required for other purposes than re-inspection and might justifiably have formed the basis of an over-riding General Regulation.

We are here concerned mainly to point out, as we do in more detail on another page, in what way the revised Regulations differ from their predecessors. They are necessarily conservative, since official recognition can be accorded only to material, appliances and methods that have proved safe in practice.

The Committee realises that new designs or methods that are not covered by its recommendations may safely be used. These cannot be described, however, as complying with the I.E.E. Regulations. That is unfortunate, as compliance should, ideally, be regarded as the hall-mark of good work. Nevertheless, it should not be necessary to wait several years before the use of the new products mentioned in the eleventh edition is recognised.

It will be pertinent to consider, therefore, whether the present machinery (including the framework of the Regulations) is the best that can be devised for keeping abreast of developments.

Installation Practice

THE electrical contractors assembled at Brighton last week attempted the impossible when they were called upon to discuss the voluminous conference paper on "Advances in Installation Practice" in about an hour and a half. As we said in our last issue, each of the five sections required special attention. As a result two tendencies were discernible. Some speakers attempted to refer to all the sections, while others picked out one or two matters dealt with. We anticipated that Mr. Gilbert's remarks on earthing, in conjunction with a brief reference to the matter by Major Smith, would prove the most attractive to speakers, and so it turned out. Mr. W. R. Rawlings went all the way, and further, with Major Smith in his advocacy of the earthed bare-neutral system, with all appliances bonded and with two-pin non-reversible plugs. But Mr. Gilbert received a goodly measure of support, notably from Mr. F. W. Purse, who made what Mr. A. G. Bruty professed to consider a remarkable admission—that supply engineers could learn something from contractors. Plugs and sockets appeared to be the next most favoured topic, but apart from Mr. Purse's advocacy of the flat pin, little of consequence emerged. We refer readers to the report and the discussion in this issue, suggesting that they may have other points which would form useful contributions to our Correspondence columns.

Unskilled Labour

REFERRING to the number of unemployed members in the London area, the June *Electrical Trades Journal* (official organ of the E.T.U.), says that among some of the London branches of the Union "it has been too much the custom that no matter what qualifications a man may have, if he is working as a mate on a job he is asked to take out a ticket in the Electrical Trades Union." At the same time branches have passed resolutions that there should be no admissions of any kind to the Union while the "vacant book" was being used to the extent to which it is. The *Journal* deprecates this rather damaging form of "dilution" and all those who want to see a high standard of workmanship maintained in the installation trade will back its protest.

Gas Turbines

WHILE only one gas turbine has so far been designed, we believe, primarily for the production of electricity (the 4,000-kW unit for the emergency station of Neuchatel) there are several on order or in operation for gas compression such as is required for the Velox pressure-combustion boiler. The tendency is, according to *Power*, towards the adoption of the continuous-combustion type as distinct from the earlier explosion type. Its development has had to await the production of metals capable of withstanding the high temperatures that are required to enable the turbine to produce a net output after the initial compression of the gas. Thus, an overall thermal efficiency of from 15 to 18 per cent., related to the production of electricity, is regarded as possible at 1,000 deg. F. and up to 23 per cent. at 1,200 deg. An equivalent result (i.e., 23 per cent.) is said to be obtainable by preheating the air and by employing one turbine to drive the compressor at the best speed of the latter and a second to drive the generator at constant speed. As no water is required in operation and a substantial weight reduction is claimed, the gas turbine should have a scope that metallurgical advance will increase. In the paper which he read before the Institute of Mechanical Engineers last winter, Dr. Adolf Meyer drew attention to the advantages of the combustion turbine for peak-load and stand-by purposes.

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Power Engineers' Salaries

FOUR years ago the National Joint Board of Employers and Members of Staff (Electricity Supply Industry)—or, more comfortably, the N.J.B.—produced a Supplemental Schedule of salaries for power station staffs. This introduced the principle of service increments in two two-yearly steps and stabilised the new rates for a period of three years. Since that time it has been subject to adjustment according to the fluctuations in the Ministry of Labour cost-of-living index but this made no difference for a further year. Now, owing to a fall in the index, there has been a downward revision and so a new set of figures has been issued: they are reproduced on another page. The reduction is a small one, the maximum being about £6 per annum, which makes us wonder whether the revision was worth the trouble involved, and on this occasion power station men will certainly share our doubt. Still, we suppose it is necessary to stick rigidly to the letter of the law.

Financial Strength

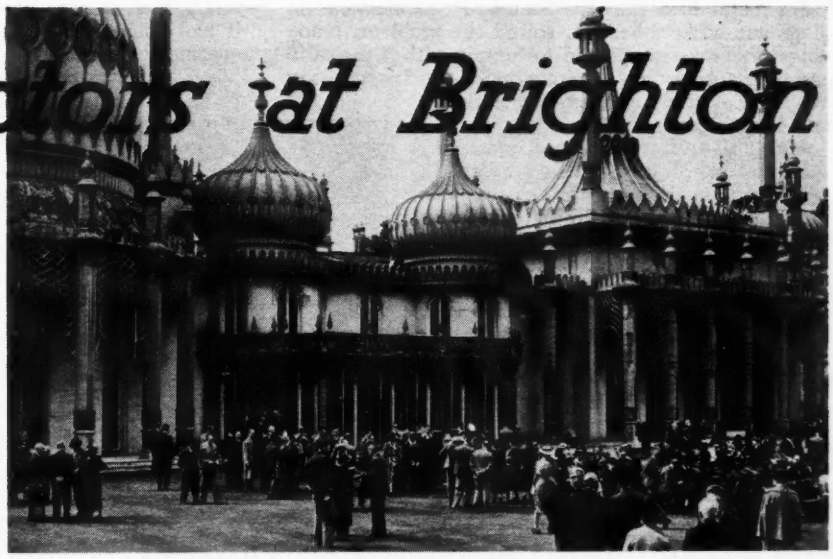
IT must be disheartening to the gas folk who like to describe the domestic development undertaken by supply authorities as uneconomic and a source of financial insecurity to observe how well those whose reports have so far appeared have weathered the difficult conditions of the past year. With crises following close on the heels of trade "recession," and in spite of the burden of increased costs, reductions in charges are still being made. Birmingham, which is pushing ahead with development schemes costing many thousands of pounds, and last year had to face an increase in expenditure of not far short of a quarter of a million pounds, owing to the rise in the cost of coal over the 1935-36 average price, is yet able to record a surplus of £298,798 as compared with £192,538 in the previous year, a very satisfactory result even after allowing for a £60,000 income tax saving. In February last, the Electric Supply Committee was given authority to capitalise expenditure on meters, time switches and hired apparatus, and it is an indication of the undertaking's financial stability that this has not been necessary.

Public Lighting

ELECTRICITY continues to make good headway in the public lighting field. In this issue we record a proposal to convert 2,000 gas lamps at Cardiff, the acceptance of the Isle of Thanet Electric Supply Co.'s tender for lighting the whole of the Broadstairs and St. Peters urban district, involving the displacement of many gas lamps, and other electric lighting schemes at Willingdon (Sussex), Newark, East Challow (Berks), Selston (Notts), Shildon (Durham) and Stoke-on-Trent. In its annual report the Birmingham Electric Supply Department reveals that nearly 2,000 more electric lamps have been erected during the past year. Gosport recently decided to replace its gas lighting by electric lamps, although the electrical tender was more than £1,000 in excess of the gas company's, the view of the majority of the Council being that electricity was preferable for the lighting of the town's streets. Not much attention was paid to the "scare" remark that supply failures caused towns to be plunged into darkness.

Contractors at Brighton

Business and Social Events at Last Week's Conference



The garden party on the East Lawn of the Royal Pavilion

ALTHOUGH it was the thirteenth of the series, last week's annual conference of the Electrical Contractors' Association proved to be one of the best held so far. The placing of the Royal Pavilion, Brighton, at the disposal of the Association by the Corporation practically assured success, for the arrangements there are admirably suited for such affairs.

About 470 members and friends attended and in spite of Brighton's counter-attractions most of them were seen at the business and social functions which commenced on the Wednesday evening with a reception at the Grand Hotel by the President, Mr. Walter Riggs, and his daughter, Mrs. G. F. Bedford, who were accompanied by the Mayor and Mayoress of Brighton, Councillor J. Talbot Nanson and Mrs. D. Scott Prime.

At the opening session : listening to the presidential address

During the evening a dance was held in the hotel ballroom and a cabaret show, including a remarkable roller-skating act by the Barbara Trio, was presented.

On the following morning the conference was officially opened by the President and a civic welcome was extended by the Mayor, who was accompanied by a number of members of the Corporation, including Alderman H. J. Galliers, who is a well-known member of the Association. His Worship mentioned that the Association's first conference was held in the town thirteen years ago. Since that time there had been a great deal of electrical progress. He referred particularly to the electrification of the Southern Railway's line to Brighton which had led to a service of about ninety trains a day from London and a considerable reduction in travelling time.

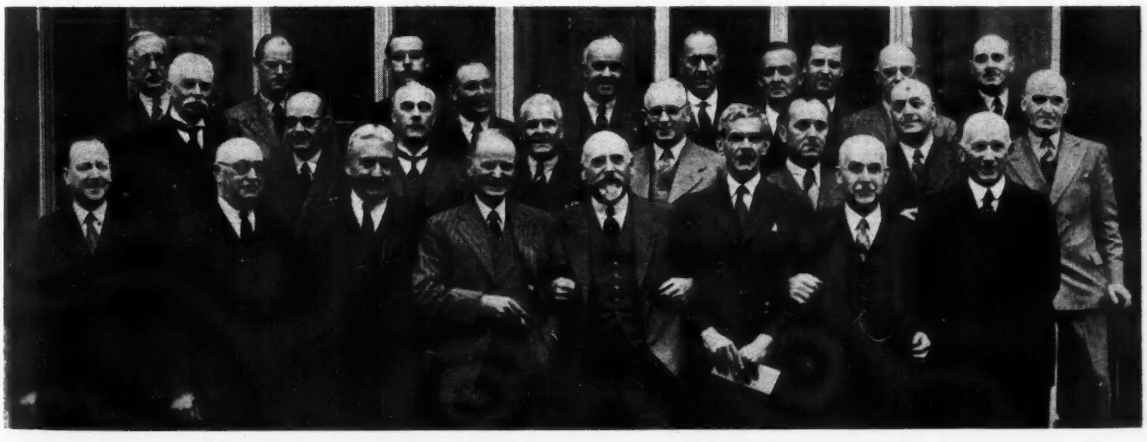
In such days as these trade associations should work even more closely together to make them a combined force in the service of the country.

Mr. Riggs thanked the Mayor for his welcome and then delivered his address, a summary of which appeared in our last issue.

The Paper Discussed

Owing to the length of the conference paper, which was also dealt with by us last week, the President made a short review of the ground covered by the five parts and then called the first speaker, Mr. Howard Long (Birmingham).

Referring to the heating of lighting flex, Mr. Long said that E.R.A. tests had shown that both the special rubber and asbestos types deteriorated under the intense heat. He agreed that the bus-bar distribution system was excellent in factories, where lighting points were constantly being altered.



The President and Members of the Council

Left to right. Front row : Messrs. J. D. Green, W. H. Walton, A. Smith, G. F. A. Norman, W. Riggs (President), E. A. Reynolds, W. R. Rawlings and H. E. Walker. Second row : Messrs. H. Marryat, T. E. Alger, R. G. Payne, F. H. Jennings, F. J. Smith, J. G. Briggs, T. C. Gilbert and H. Jones. Back row : Messrs. F. W. Marshall, H. M. Drake, C. R. Spouge, C. D. James, J. Walsh, E. Kidd, A. G. Bruty, S. Dickinson, E. W. Andrews and G. Ollier

He maintained that the Standard Specification for plugs and sockets had not solved the problem; many plugs which were supposed to comply with it varied in certain respects. He also mentioned the divergence of views on earthing between Major Smith and Mr. Gilbert.

Mr. H. Marryat (past-president) thought that Major Smith's proposal to revert to the earthed neutral system was important; the old Andrews concentric system was the best ever introduced. He agreed that the neutral, as such, should be abolished in favour of multiple earthing. Probably the opposition of the Post Office had prevented its adoption, although thorough tests had shown that it caused little trouble.

The bus-bar distribution system was a very great convenience in view of the constant changes in factory layout and it also was immune from fire risk. Bus-bar ducts should not be used as ventilating shafts as deposits of dirt would form on the insulators and thus reduce their effectiveness.

Mr. L. C. Penwill, the Director and Secretary

Dealing with Mr. Gilbert's contribution, Mr. Marryat said that there was much prejudice against earth-leakage protection in this country owing to misunderstanding of its objects and to the unsatisfactory nature of the earliest trips introduced here. It was not merely a substitute for the earth plate. He considered that the paper as a whole was the biggest contribution to the subject of improved installation work for many years.

Mr. G. F. A. Norman (vice-president, London) did not consider that a floor duct circuit could always obviate visible wiring and even with it cutting away was often necessary. It was certainly useful in an island site. He would have liked more information about the cost of the system and thought that the standardisation of two types of duct was undesirable.

Teatime at the garden party

Mr. A. J. McColgan (H.M. Inspector of Factories) said that the combination of neutral and earth wire would be dangerous in the case of the breaking of a conductor as it would leave portable apparatus "alive." The I.E.E. had recognised the earth-leakage trip system but had wanted to be satisfied about the apparatus; it had therefore requested the B.S.I. to produce a specification. This was about to be published and he hoped that apparatus would conform to it.

He agreed that the system was valuable but the "snags" should not be overlooked. Mr. Gilbert stated in the earlier part of his paper that it was often impossible to keep conduits, ducts, &c., isolated from steel frameworks and water or gas pipes; later he said that the insulating of motors from structural steelwork and the insertion of an insulating section in the conduits feeding them were not very serious problems.

Supplementary earthing was useful to back up the ordinary overload protection. The circuit should be broken immediately on the occurrence of a fault and in the solid earthing system that was a matter of calculation. If leakage current persisted and the fuses did not blow there was a risk. He quoted an instance of a large building in which the circuits were fused for 200 A and the earth resistance was 2 ohms. On the occurrence of a fault the fuse failed to blow and a fire was caused. In similar circumstances a conduit bond melted and put a potential on an acetylene gas pipe by which an explosion was caused.

In some installations a leakage potential of 20-30 V was not permissible and a solid system with a low-resistance earth was essential. Leakage-trip protection was valuable but its limitations should be recognised.

Mr. F. W. Purse (chief engineer, London J.E.A.), said supply engineers would learn a great deal from the paper. Nowadays single installations were equivalent to the whole of the load of some stations of a few years ago. He welcomed the duct system and referred to the G.P.O.'s work in this direction.

With really satisfactory plugs and sockets it would be possible to rely upon the Standard Specification, but how they could produce by mass production a perfectly fitting round pin in a round hole he did not know. In heavier switchgear flat contacts were always used and he con-

Members of the Birmingham Branch of the Association

E.C.A. Members and Friends at the Brighton Conference

1, Messrs. L. Lee, G. Ollier and P. J. Frampton ; 2, Messrs. S. H. Sawyer, A. H. B. Elley and W. F. Cartwright ; 3, Messrs. T. J. S. Morgan, D. P. Toomey and W. L. Edwards ; 4, Messrs. W. J. Rawlings, H. Marryat, E. S. New and H. M. Drake ; 5, The President and Mr. W. R. Rawlings ; 6, Mrs. E. E. Hoadley, Mrs. J. W. Simpson and Mrs. E. J. Melville ; 7, Messrs. H. E. Walker and H. A. Lingard ; 8, Messrs. F. Swarbrick, H. Lingard and E. Sawyer ; 9, Messrs. H. C. Hazel and R. E. Briscoe ; 10, Messrs. T. E. Dickinson and G. P. Bainbridge ; 11, Major P. A. Smith and Mr. R. A. Marryat (two of the authors) ; 12, Messrs. B. Gill, A. G. Bruty and A. O. Bruty

sidered that what was needed was either a flat-pin plug or a round-pin plug much different from the present types. He did not think that the lack of standard sizes really caused much inconvenience.

A Yorkshire group: Messrs. A. Smith, G. W. Allenby, J. D. Green, T. A. Garness, J. Innes, F. W. Rhodes, and A. S. Pratt

The speaker paid a tribute to Mr. Gilbert for his pertinacity in his advocacy of the earth-leakage protection system. At present the trips were too expensive but the system would come into its own. He thought, however, that we would never get rid of earthing to water pipes and recently an agreement had been reached with the water authorities on the subject. He had shown the water companies that earthing to their pipes was actually more advantageous to them than the use of separate earthing plates.

Mr. E. S. New, referring to Mr. Reynolds's remarks regarding manufacturers' associations, claimed that the Accumulator Manufacturers' Association had complete control over its members. Standardisation had been attempted; the Government departments were using the Specification but contractors were not.

Mr. A. G. Bruty (past-president, Dublin) maintained that the "high light" of the discussion was Mr. Purse's admission that supply engineers did not know everything. Referring to Mr. R. A. Marryat's section, he said that it was very pleasing to have a paper from one of the younger members of the Association. He considered, however, that it would have been useful, particularly to the smaller contractors, to have had more details of cost of the bus-bar distribution system, worked out from a typical example.

He believed that Mr. Gilbert slept with a leakage trip under his pillow. His own experience of the system led him to endorse all that Mr. Gilbert had said.

A National Neutral

Mr. W. R. Rawlings (past-president) expressed the opinion that the whole of the present system of wiring was wrong. We had an earthed neutral system and did not use it; there should be one solid uninsulated earthed neutral surrounding the conductors throughout the country. This would do away with double-pole fuses, a separate earth wire, &c. Each conductor should be fused and every connection to it should be fused separately. He considered that a reversion to the old Andrews system would rid us of a great deal of trouble, although Mr. Gilbert would not agree. There were places with an earthed neutral system but in his opinion the earthed neutral should be "bolted up solid" all over the country.

He concluded by counselling contractors not to be slaves to existing methods but to look forward to something better.

Mr. W. J. Jones (deputy-director, E.L.M.A.), dealing with Mr. Reynolds's remarks on the heating of conductors and lampholders, said that discharge lamps installed in properly designed fittings diminished this problem considerably.

At the garden party: Including Mr. and Mrs. K. R. Mackley, Mr. and Mrs. A. Winstanley, Mr. and Mrs. T. K. Richardson and Mr. G. A. Chard.

The President then called upon the authors to reply to the discussion. Mr. E. Jacobi, who wrote the section on duct systems, was unable to be present. Major P. A. Smith made the first reply, in the course of which he said that v.i.r. cable could be made to withstand a temperature of 150 deg. F. with safety and there were other good heat-resisting types.

The earth-leakage protection system could be used in conjunction with solid earthing; the only real danger was where earthing took place at the power station. The combined neutral and earth meant multiple earthing. The concentric system with non-reversible two-pin plugs would certainly leave portable apparatus alive if the flex failed but as the apparatus would refuse to function attention would be drawn to it.

He thought that the air-insulated bar system of distribution was cheaper to install than insulated cable for any load above about 500 kW.

Some of the local stewards who were largely responsible for the successful conference

Mr. R. A. Marryat said that while heat-insulated rubber cables could be connected to the bare bus-bar system it was unsatisfactory to introduce inflammable material into the duct system. Fuses could be fitted and insulated with non-inflammable material. Actually dust drawn into ducts had little effect upon non-tracking insulators.

As regarded cost, it was difficult to choose a typical installation but generally an AC system cost a little more than DC. Where there was a load of up to 200 A in each bay of a factory, there was little difference in cost between the air-insulated bar system and armoured cables but above this the bar system was far more economical. For rising mains the equivalent figure was 500 A per conductor, but the saving in cost of subsequent additions and alterations had to be borne in mind.

Fuses were provided at local connection points in the bar system. There was a growing tendency to install low-voltage lighting on machines; in this case the necessary transformers could be connected between two phases of the system with little trouble.

Mr. E. A. Reynolds said that higher temperatures than 150 deg. F. were experienced at lampholders. Varnished cambric insulation with asbestos covering was not satisfactory. Asbestos alone was better, for although its insulation value was lowered by its tendency to absorb moisture it soon dried out and little harm was done. He believed that contractors had not yet fully appreciated the value of short slow-break AC switches, although they regularly used short-break thermostats. Manufacturers claimed to conform with the plug and socket Specification but there were still many badly-fitting models. In principle the Specification required a solid pin, any necessary adjustment being made in the socket.

He expressed appreciation of Mr. Rawlings's proposals but pointed out that country areas were often far removed from his "solid block of earth."

Mr. T. C. Gilbert said that although theoretically the concentric system was a good one it had been abandoned by every country which had tried it. In the United States the water authorities had attributed many troubles on their systems to the use of the earthed bare neutral and Australia was prohibiting the use of water pipes for earthing purposes. This was significant when the concentric system depended upon the water pipes for its success.

Another group at the garden party closely inspects the pond

He considered that finality had been reached in solid earthing and we had to look around for a new system, although this term could not really be applied to the earth-leakage protection method which had been standard practice abroad for ten or twelve years.

Although the English water companies had permitted earthing to their systems we could not remain dependent upon them. He could not agree that effective fusing would solve all earthing troubles.

This concluded the session and the afternoon was left free to enable the delegates to take advantage of the facilities in the way of bathing, golf, tennis, &c., which had been placed at their disposal.

Mr. and Mrs. Marryat with the champion E.I.B.A. flag-seller, Miss Bailey

In the evening they gathered again at the Royal Pavilion where they were received by the Mayor and Mayoress, Alderman Galliers acting as announcer. Both the ballroom and the music room were called into service for the subsequent dance which continued until half-past twelve.

Mrs. G. F. Bedford (the President's daughter), the Mayor and Mayoress of Brighton, Mr. H. M. Drake and Alderman H. J. Galliers

Closing Session

The annual general meeting took place on Friday morning, when it was announced that Mr. Riggs had consented to serve another year as President. After an interval for coffee the delegates assembled for the closing of the business sessions.

Mr. Riggs expressed sincere appreciation of Brighton's hospitality and the Mayor in his reply made particular reference to the activities of Alderman Galliers in preparing the way for the conference. He suggested that the Association should not wait so long before going to Brighton again.

Thanks were then accorded to the authors of the paper, those who contributed to the discussion, the local stewards, the local golf clubs which had placed their courses at the members' disposal and all who had helped to make the conference the success which it undoubtedly was.

Mr. A. G. Bruty proposed a vote of thanks to the President, paying a tribute to his good work in diverse spheres. He said that the conferences continued to progress in enjoyment and efficiency. The vote was seconded by Mr. W. F. Furse (Nottingham) and enthusiastically accorded.

Garden Party

Tables and chairs had been put out on the East Lawn of the Pavilion in preparation for the afternoon's garden party but slight showers caused their return to the Pavilion. The afternoon was fine, however, and the visitors thoroughly enjoyed the programme provided by the band of the 2nd Battalion of the Royal Sussex Regiment and the strawberries and cream which are a regular feature of these events.

A smoking concert at the Grand Hotel, followed by a long-continued dance, wound up the proceedings.

THE COLLIERY ELECTRICIAN

His Work, Status and Training

By D. W. Lyall, B.Sc. (Hons.), A.M.I.E.E.

AN indication of the work of the colliery electrician is provided by a brief summary of the equipment of a modern electrified colliery. This may include a generating station, or a sub-station receiving a bulk supply, either from the colliery company's own central station or from a public supply authority; high-voltage pit shaft feeders; a medium-voltage underground distribution system, possibly covering several square miles of area and undergoing frequent changes; motors and control gear, above and below ground, for winders, fans, pumps, haulages, coal-cutters, conveyors, drills and screening and washing plant, with an aggregate horse-power of the order of 2,000 to 5,000.

In addition, there are telephones, signalling bells and indicators, and fixed and portable lighting. Most of the underground equipment is specially designed and constructed for colliery work, to ensure safe working in gassy situations and to withstand the rough handling which often comes its way. The fitness of the plant for its work is ensured by the stringent tests imposed before certification by the Safety in Mines Research Board's testing station at Buxton, but the preservation of the plant in its originally safe condition requires intelligent and careful, almost fastidious, maintenance.

Statutory Qualifications

One result of the rapid growth in the use of electricity for mining has been to increase greatly the importance of the colliery electrical staff, upon whose work the safe and uninterrupted working of the mine may largely depend. Yet the present position of the colliery electrician is unsatisfactory, being that defined in the "General Regulations as to the Installation and Use of Electricity," under the Coal Mines Act of 1911, as "a person appointed in writing by the manager of the mine to supervise the apparatus in the mine and the working thereof, such person being a person who is over 21 years of age, and is competent for the purposes of the rule in which the term is used."

The position is that while the electrician must in practice make himself responsible for the proper maintenance of the plant, the manager is required to accept the legal responsibility for its condition. This arrangement was perhaps satisfactory a quarter of a century ago, but it leaves much to be desired to-day.

It has been recognised for some time that colliery development has reached a stage at which a more precise definition of the duties and qualifications of the engineering staff is desirable. The 1930 report of the Holland Committee of inquiry into the qualifications of mines officials recommended that the duties and responsibilities of electricians and engineers should be defined by statute, and that "the question of qualifications should be considered at a later date." Again, the report of the Royal Commission on Safety in Coal Mines, published towards the end of last year, recommended that electricians and their assistants should have statutory qualifications, and that statutory responsibility should rest upon the electrician-in-charge for the proper performance of his duties. These recommendations are welcomed by many colliery electrical men as opening up the possibility of some future improvement in status for qualified men.

Training Schemes

In view of the somewhat indefinite position up to the present, it is not surprising that schemes of technical instruction, specially directed towards the training of colliery electricians, have not reached the same national uniformity as those in general electrical engineering. A number of schools, however, provide courses on the lines suggested by the Association of Mining Electrical Engineers, which has done, and is doing, much valuable work in this direction, and have established examinations and certification in three stages, (*a*) second class, (*b*) first class, and (*c*) honours, which are intended to correspond, respectively, to the requirements of the assistant electrician, the electrician-in-charge at a colliery, and the electrical engineer of a colliery group.

The second and first class examinations demand a good knowledge of electricity applied to mining, including papers on lighting and signalling, regulations and general electrical technology, and involve courses of study of two and three years' duration respectively. The honours stage is of a higher technical standard, and involves a part-time course of about five years.

Alternatively, the colliery electrician seeking a technical training may elect to take an ordinary course in electrical engineering, requiring from five to seven years of part-time study (very few are able to proceed to a full-time course). Courses of this type have been organised nationally at recognised centres by the efforts of the Board of Education and the Scottish Education Department in conjunction with the Institution of Electrical Engineers. The successful student may obtain an Ordinary or Higher National Certificate, or the certificate of the City and Guilds Institute in electrical engineering practice, or possibly become a graduate of the Institution of Electrical Engineers.

Whichever course he may take, the student will seldom find the path strewn with roses, his study being often interfered with by emergency overtime work or by the three-shift system. The "back" shift (2 p.m. till 10 p.m.) is a particularly awkward one, but is in some districts catered for by classes held between 9 a.m. and noon. At these classes every effort is made to maintain continuity with the evening classes which the same students will probably attend in the following week, although difficulty may arise in this respect owing to the smaller number of teachers available for morning classes. Again, students working on night shift often find it necessary to leave the evening class some time before its completion in order to get to work at 10 p.m.; especially is this so in the case of students living or working at some distance from the school.

Drift to Other Industries

In spite of these and other difficulties, many succeed in providing themselves with a good technical training, thus enhancing their value as engineers, but it would seem that the coal industry does not at present hold out enough inducements for men of this type, because many find employment in other branches of electrical engineering where conditions of work are less arduous and remuneration better. No doubt some obtain positions as chief electricians in charge of colliery groups, but any modification in conditions which will result in the retention of a larger proportion of these engineers is to be welcomed by all interested in colliery work.

The leading colliery companies are taking a very active interest in the training and welfare of their apprentices. In some cases, satisfactory school reports or examination successes are rewarded by a wage bonus, and at least one firm has an annual "scholarship scheme" for engineering apprentices, in which selected lads are sent on a fortnight's tour of the works of leading manufacturers of engineering equipment at the colliery company's expense.

In addition, an increasing number of firms are arranging, in conjunction with local education authorities, schemes whereby selected youths are given school instruction for two or three full days per week, wages being paid for time spent at school. These full-time schemes are at present mainly for mining students, but may in future be extended to include a proportion of electrical and mechanical apprentices. Such schemes, of course, provide better opportunities for the trainee than any part-time course involving study at the end of a day's work.

Research Board's Help

Mention should be made of the important, if unobtrusive, part played by the Safety in Mines Research Board in promoting the spread of what may be called "safety knowledge" among colliery electricians, not less than among other colliery workers. Important results of research, bearing directly upon matters of mine safety, have been made available in the form of booklets and pamphlets so lucidly written as to be readily understood by any who are interested.

The future outlook for the colliery electrician is encouraging. Though the rapid progress of mechanisation and electrification in collieries has left the matter of engineering staff organisation somewhat in arrears, there appears to be every possibility of this being remedied in the near future. The laying down of statutory requirements as to duties and qualifications would simplify and co-ordinate practical and technical instruction, and might lead to the adoption of nationally approved schemes of instruction. One may look forward, also, to the colliery electrician acquiring a status more in accordance with the importance of his work in one of this country's greatest industries.

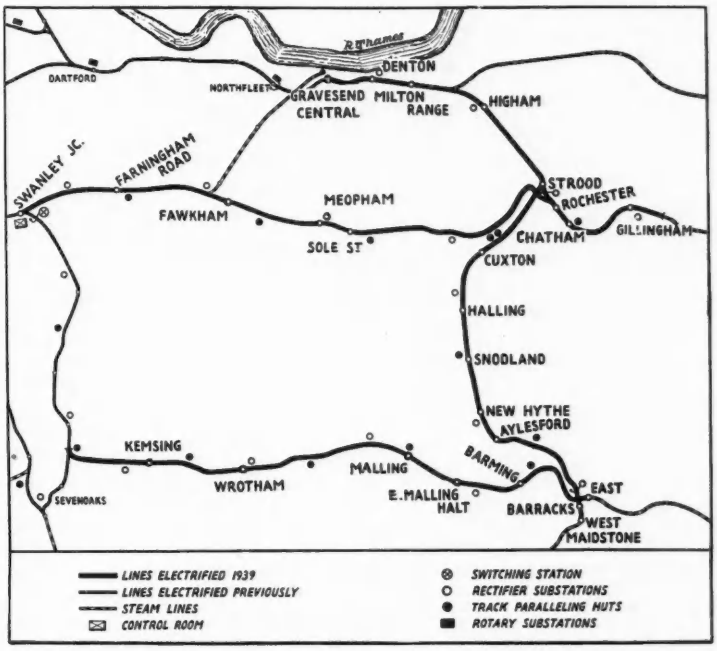
S.R. ELECTRIC EXTENSIONS

Completion of Five-year Programme

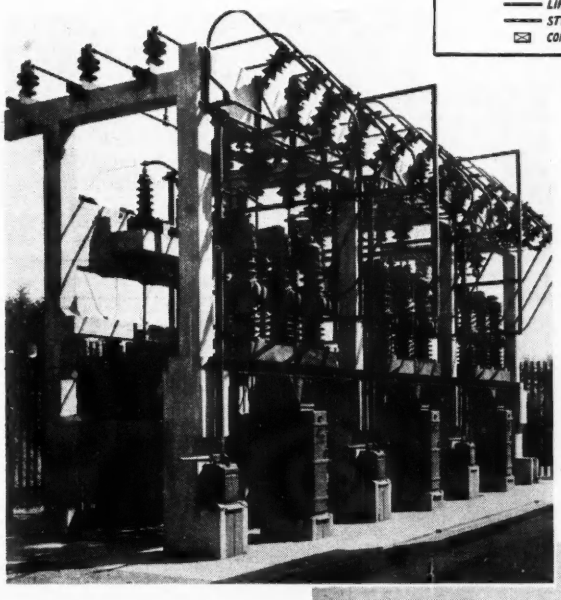
TWENTY-TWO towns and stations benefit from more and faster trains provided by the Southern Railway Co.'s latest extension of electric traction in Kent. The routes concerned, which were inaugurated on Sunday last, July 2nd, are those between Swanley and Gillingham, Otford and Maidstone (East) and Gravesend (Central) to Gillingham and Maidstone (West) via Strood. The total cost of this scheme has been £1,750,000, and it has added 54 route miles of electrified track. It represents the completion of the five-year plan of semi-main line electrification, undertaken with the financial aid of the Railways Agreement Act, 1935, during which period 267 route miles (619 track miles) have been converted and 828 electrically operated vehicles built at a cost approximating to £8,500,000.

Thus the Southern route mileage now electrified totals 702 (1,742 track mileage) at a cost of £20,500,000. The 158 sub-stations have a combined capacity of 484,000 kW; each contains one 2,500-kW mercury rectifier, except two containing two each. The number of vehicles is 3,189, running 41.25 million train miles per year.

For these Medway lines 76 two-car trains have been built at the Eastleigh and Lancing works of the Southern Railway. In view of the outer-suburban character of the services, equipment comprises two standard nose-suspended motors, with an individual one-hour rating of 275 h.p. at 27 m.p.h.,



New electric lines in north-east Kent inaugurated last Sunday



New substation, Meopham, and right, Strood Junction signal box

mounted on the outer bogie of the coach. Traction control of the electro-pneumatic unit-switch type is carried below the underframe; all low-voltage control circuits are fed from a potentiometer. The 660-V control gear is almost identical with that of the express stock built within recent years.

The Swanley control room is now twice its original size in area; the 14 panels have been increased to 54, and on one of them are diagrams representing the whole of the main power circuits delivering energy to the conductor rails.

The Central Electricity Board's step-down transforming sub-station at Northfleet, which is one of the supply points for the Sevenoaks area, is the main source of electricity supply to the newly converted lines.

Of the 15 track sub-stations built, 13 differ from those previously constructed by the Southern Railway. They are all of the rectifier type, of the same size and similar technical lay-out; but economy of space has resulted from the installation of " minimum oil " circuit-breakers of the " contraction "

a corridor has been introduced in half of the stock. Each twin-car set comprises a motor coach of the third-class compartment type and a driving trailer coach with side corridor, but without vestibule connections. As the stock has an overall body width of 9 ft. compared with the 8 ft. 6 in. of the previous stock used for the electrified lines, third-class non-corridor compartments will allow of six persons sitting on each side.

A new departure is that the side windows are oval instead of the usual oblong shape. Lighting is by two 60-W ceiling lamps in each compartment. The driving

class, mounted out of doors. They are of the single-pole, single-break type, with combined isolating switch, formed into three-phase sets on steel channels suspended between the vertical joists of the reinforced concrete structure which supports the whole of the 33 kV switchgear, arranged in bays for the individual circuits which are separated by screens and can be isolated. The current transformers for protective purposes are separately mounted, and of the ring type. Auxiliary supplies are provided by two 45-kVA three-phase transformers connected through high-voltage switch-fuses to each of the incoming feeders.

The layout of the indoor equipment has also been modified. The annexe has been abandoned, and a recooler of a new type is now situated behind the rectifier itself. Thus a completely rectangular building results, which in a four circuit-breaker type building, measures 40 ft. by 18 ft.

As before, the converting plant comprises an oil-cooled step-down transformer mounted outside the end wall, directly connected to a mercury arc rectifier immediately adjacent inside the building. The rectifier is of the steel-tank type of 2,500 kW at 660 V continuous rating, with the usual closed-circuit water cooling thermostatically controlled, but the anodes are air-cooled instead of being water-cooled as hitherto. Another new feature is arc suppression equipment, which consists of controlled grids intended to suppress the arc under a backfire condition, and to ensure that the supply is automatically re-established.

Track-paralleling huts containing automatic high-speed circuit-breakers are placed midway between the sub-stations, all of which are unattended and operated by the same supervisory system of control as previously employed.

At Swanley a new signal box with 80 levers has replaced two old boxes, and at Strood two new boxes have been constructed to supersede three former ones, while 150 track circuits have had to be installed and over 20 miles of main signalling cables have been laid.

Over 250 miles of telephone wires have been run and 80 telephones installed throughout the area to give additional facilities for the Traffic Operating Department and for communication between sub-stations and the control room.

This scheme has involved a considerable amount of civil engineering work, including a new station at Swanley, rebuilding at New Hythe and extensive alterations at Maidstone East and Strood. The latter station will eventually be rebuilt at a cost of £75,000. Chatham station is to be modernised.

Throughout the three sections station platforms have been raised and, in many cases, lengthened. Additional sidings have also had to be provided at some stations for berthing coaches. At Gillingham a new car shed has been constructed, 820 ft. in length with four roads inside and three berthing sidings outside, and provided with an electric carriage washing machine and vacuum cleaners.

The principal contractors included: English Electric Co., Ltd., electric train equipment, Asea Electric, Ltd., high-voltage switchgear and supervisory control equipment; British Insulated Cables, Ltd., low-voltage cables and track bonds; British Thomson-Houston Co., Ltd., high-speed circuit-breakers; Chloride Electrical Storage Co., Ltd., sub-station and control room batteries; W. T. Henley's Telegraph Works Co., Ltd., multi-core cables; Pirelli-General Cable Works, Ltd., high-voltage and pilot cables; Metropolitan-Vickers Electrical Co., Ltd., lamps; Taylor, Tunnicliff & Co., Ltd., third rail insulators; Westinghouse Brake & Signal Co., Ltd., signalling and brake equipment; Edmundson's Electricity Corporation, Ltd., control room and sub-station lighting; and W. T. Glover & Co., Ltd., train equipment cables.

Power Station Staffs' Salaries

Small Downward Adjustment

AFTER remaining stable for the past four years the salaries of power station engineers are to be slightly reduced, owing to the operation of the cost-of-living index figures, as from July 1st. They will remain at the new level until the end of the current year when they will again come under review.

The revised Supplementary Schedule produced by the National Joint Board of Employers and Members of Staff is printed herewith in an abbreviated form which gives the salaries payable to the nearest £.

The letters appearing in each class show (a) the salary for the first two years of service; (b) for the next two years; and (c) after four years' service. Certain of the grades bear definite descriptions:—Grade 1 is deputy chief official; 3, power station superintendent or mains superintendent (with charge of sub-stations); 4, mains superintendent (without charge of sub-stations); 8, shift charge engineer; 8b, sub-station charge engineer; 9a, switchboard attendant.

The variations, additions and amendments provided for in the 1923 agreement remain in force. For instance, employees in the London area are entitled to an addition of 5 per cent., and in any district where conditions justify lower remuneration a deduction of 5 per cent. on the schedule rates can be made by agreement.

THE SCHEDULE OF SALARIES

(Capacity or maximum demand in kW.)

Grade		1	2	3	4	5	6	7	8	8a	8b	9	9a	10	10a	10b	10c	11	11a	11b
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Class A 1,000–2,000	a...	471	407	365	312	294	265	238	238	221	205	—	—	—	—	—	—	—	—	—
	b...	482	417	374	323	302	275	247	242	225	207	—	—	—	—	—	—	—	—	—
	c...	494	427	383	335	310	285	255	247	228	211	—	—	—	—	—	—	—	—	—
Class B 2,001–4,000	a...	505	437	392	346	318	296	265	252	232	214	—	—	—	—	—	—	—	—	—
	b...	521	451	405	354	329	302	275	256	235	216	—	—	—	—	—	—	—	—	—
	c...	538	465	419	362	339	310	285	260	238	220	—	—	—	—	—	—	—	—	—
Class C 4,001–6,000	a...	554	480	433	370	350	316	296	265	242	224	205	—	—	—	—	—	—	—	—
	b...	564	489	440	381	357	326	301	274	250	229	210	—	—	—	—	—	—	—	—
	c...	574	498	449	394	364	336	306	282	257	235	215	—	—	—	—	—	—	—	—
Class D 6,001–8,000	a...	584	507	457	405	371	346	312	291	265	241	220	205	—	—	—	—	—	—	—
	b...	599	521	470	417	381	352	320	296	271	246	225	210	—	—	—	—	—	—	—
	c...	613	535	482	427	391	358	330	301	276	253	231	216	—	—	—	—	—	—	—
Class E 8,001–13,000	a...	—	549	496	439	401	364	338	306	282	258	237	220	205	—	—	—	—	—	—
	b...	—	563	502	445	412	374	347	315	290	266	242	224	207	—	—	—	—	—	—
	c...	—	578	509	451	423	384	357	323	298	274	250	226	208	—	—	—	—	—	—
Class F 13,001–25,000	a...	—	—	516	458	434	394	365	332	306	281	256	229	211	—	—	—	—	—	—
	b...	—	—	528	474	439	403	370	339	314	288	263	234	212	—	—	—	—	—	—
	c...	—	—	541	490	446	412	375	347	320	295	269	238	214	—	—	—	—	—	—
Class G 25,001–50,000	a...	—	—	554	506	452	421	379	355	328	301	275	243	216	205	—	—	—	—	—
	b...	—	—	568	518	467	431	393	359	333	307	282	250	221	210	—	—	—	—	—
	c...	—	—	582	529	481	440	406	363	338	314	289	255	226	215	—	—	—	—	—
Class H 50,001–100,000	a...	—	—	597	541	497	450	419	368	343	319	296	262	231	220	205	—	—	—	—
	b...	—	—	617	555	506	464	427	379	354	328	302	270	238	225	210	—	—	—	—
	c...	—	—	637	570	517	479	436	392	363	336	310	276	245	230	215	—	—	—	—
Class J 100,001–150,000	a...	—	—	656	584	526	493	443	403	374	345	316	284	253	236	220	205	—	—	—
	b...	—	—	673	600	541	506	456	415	384	355	325	293	260	242	225	210	—	—	—
	c...	—	—	690	616	555	520	467	425	395	364	335	300	267	249	231	216	—	—	—
Class K 150,001–200,000	a...	—	—	708	631	569	533	479	437	405	374	343	309	275	255	236	220	205	—	—
	b...	—	—	727	648	584	547	493	449	417	384	353	317	282	263	242	226	210	—	—
	c...	—	—	745	664	600	561	505	460	427	395	362	326	291	271	249	232	216	—	—
Class L 200,001–250,000	a...	—	—	765	682	615	576	519	473	439	405	372	336	298	277	255	237	220	205	—
	b...	—	—	785	700	631	591	533	485	451	417	382	345	307	285	263	242	226	210	—
	c...	—	—	805	718	647	606	546	499	462	427	393	355	316	294	271	250	232	216	—
Class M Over 250,000	... ...	—	—	825	736	664	622	561	511	475	439	403	364	324	301	277	256	237	220	205

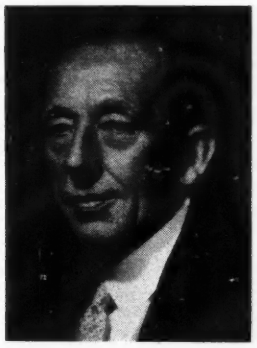
WIRING REGULATIONS

Appearance of the Eleventh Edition

IN the eleventh edition of the Regulations for the Electrical Equipment of Buildings which has just been issued by the Institution of Electrical Engineers (cloth 1s. 9d. or paper-covered 1s. 2d. post free from E. & F. N. Spon, Ltd., or from the I.E.E.) the general arrangement of matter is similar to that of the previous edition of September, 1934, but the total number of Regulations is 155 as against 196. The new edition, containing 173 pages, is the work of a committee of thirty-six (including twenty representatives of interested bodies) of which Mr. P. V. Hunter was chairman.

The main purpose of the Regulations is to secure safety from fire and shock. They apply primarily to installations working at voltages not normally exceeding 650, but they cover such high-voltage applications as luminous discharge tubes and electrode water heaters. They deal with private generation as well as with installations on the consumer's side of the point of supply from public mains. They are not applicable to telephone circuits other than mains-operated sets.

Any installation complying with the I.E.E. Regulations also fulfils the requirements of relevant Regulations of the Electricity Commissioners, to which they are supplementary as well as to various statutory regulations relating to factories, cinemas, theatres and mines.



Mr. P. V. Hunter, Chairman of the I.E.E. Wiring Regulations Committee

Principal Alterations

In this article we set out the principal departures from the 1934 edition as modified in June, 1935. The 1939 edition contains several new definitions. Among these are "consumer's earth resistance" (which includes that of the earth electrode) and "earth-free situation" which specifically excludes bathrooms, sculleries and rooms with concrete floor surfaces.

The definition of "extra-low voltage" in the 1934 edition as normally not exceeding 30 for AC and 115 for DC has been dropped, and the expression "low-voltage" covers all voltages up to 250.

One of the new general regulations is that a durable white tablet, 4in. by 2in. (minimum) has to be fixed near the main distribution fuse board with an inscription in twelve-point type to the effect that the installation should be periodically inspected and tested.

The omission of a domestic consumer's main fuses is recommended where the undertaking's fuses are of the quick-acting type and the connected load exceeds 15 A; the installation should be subdivided so that the current rating of the largest fuse shall be not greater than one-third of that of the undertaking's fuse and all consumer's fuses exceeding 15 A should also be of the quick-acting type; in such cases the number of ways in the distribution fuseboard and the connected load supplied through splitter units need not be restricted.

The provision that every circuit and sub-circuit shall be protected on each pole is modified by the insertion of the words "other than a branch derived from a cooker control unit." All single-pole switches in a two-wire installation must be fitted in the non-earthed conductor. A fuse or non-linked switch may not be inserted in the earthed pole of an installation supplied from a permanently earthed system—instead of, as previously, a system earthed at more than one point.

Where the cross section of a conductor is reduced, *e.g.*, at a branch or extension the smaller conductor should be protected not more than 50 ft. away from the joint unless the fuse rating of the larger conductor does not exceed that of the smaller.

Final Sub-circuits

Regarding the existing requirement that every final sub-circuit shall be connected to a separate way in a distribution fuse board, it is pointed out that this Regulation still applies if a plug contains a fuse. A final sub-circuit rated at not more than 25 A may serve two socket outlets of 15 A or less. A final sub-circuit feeding a cooker rated at more than 15 A may also supply one point with a 5-A fuse within the control unit.

Where a diversity factor is permissible, the current rating of a final sub-circuit supplying more than one point is to be at least two-thirds of that of all points connected to it and not less than that of the largest point. A socket outlet for DC of more than 2 A has now to be controlled by an adjacent switch.

A new provision is to the effect that the current ratings of "mineral-insulated copper-sheathed cable" need not be reduced on account of ambient-air temperatures higher than normal. Maximum values of temperatures in ducts are given for the use of various standard cables.

Unprotected Cables

Conditions of use of mechanically unprotected cables now include the need to prevent them from coming into contact with any other wiring system in the same building. Attention is drawn to the possibility of corrosion of metal in the presence of magnesium chloride (which is commonly used in the construction of flooring and dadoes) and of plaster undercoats in some cases. Tough rubber may also be damaged through contact with lime and certain cements in the presence of moisture. The tough rubber covering of v.i.r. cables not further protected by casing or conduit must be brought into the associated fittings or to the finished surface of the wall, etc., or into a recess lined with incombustible material.

Previously flexible cables could be used for fixed wiring on domestic premises under defined conditions; under the revised Regulations such use is ruled out except in temporary displays of lighting fittings in shops, when 250-V grade (BSS No. 7) cable can be used for final sub-circuits carrying not more than 6 A at a maximum of 250 V, subject to specified precautions.

Shades and candle tubes composed wholly or partly of nitrated celluloid may not be used near a lamp. Tough-rubber protected flex for supplying a lighting fitting from a plug may be carried through a plugged clearance hole to a socket outlet in the space above the ceiling.

Joints in flexible cord must be by mechanical connectors shrouded with incombustible insulation within a receptacle. Connection of an appliance by contact tubes and pins must be so arranged that separation of the two disconnects the pins from the supply. A reversible connector must not be used to connect an appliance unless every switch on the appliance is of the double-pole type.

A lampholder plug shall not be used with an appliance taking more than 1 A (instead of 2 A) or where exposed metal has to be earthed. Every plug containing a fuse must be non-reversible and the fuse must control the non-earthed conductor. The requirement that the earth terminal of a three-pin socket outlet shall be connected to the earth continuity conductor is now relaxed in the case of earth-free situations.

Fuses and Flex

Every fuse shall have on its case or adjacent to it an indication of its current rating. It is recommended that the supply authority be consulted as to the grade requisite for a consumer's main fuses. To the bathroom are added kitchens and sculleries as places in which all flexible cords should be tough-rubber protected or of an equally waterproof type, but the use of flexible cords for any purpose in bathrooms is deprecated.

A fixed heater or cooker not fed from an adjacent socket outlet, irrespective of any switches mounted on it, shall be capable of being entirely disconnected by a switch or push button fixed apart from it but within easy reach of it.

An indoor transformer having an oil capacity exceeding 50 gal. should be in a fire-resisting chamber ventilated to the outside of the building only. An auto-transformer may not be used with portable appliances (including electric toys) or for stepping up voltage when none of the supply mains is connected with earth.

Electrode Boilers

No electrode water heater or steam raiser shall be connected to a DC system. Earth leakage current from such apparatus may not exceed 10 per cent. of the normal current, except when necessary to ensure stability of operation, when it may be increased to 15 per cent. (the former 100 A maximum out of balance has been repealed). The circuit-breaker requires in addition to earth-leakage protection (operating when the shell of the apparatus rises above 50 V to earth) at least two over-current releases for three-phase apparatus. An ammeter in each phase or a multiway switch with a single ammeter is called for.

Requirements relating to the installation of luminous discharge tubes have been modified and particulars are given of the notices to be affixed to high-voltage apparatus. The section relating to mains-operated radio sets has been curtailed by the

elimination of six regulations dealing with cases, protection of live parts, isolation of terminals (with its three-page table), condensers, transformers and insulation-resistance tests.

Under the head of "earthing," important new matter has been introduced. It is strongly recommended that electrical apparatus of the all-insulated type should be installed wherever practicable, that the use of apparatus (particularly toasters and hair-dryers) having exposed metal parts should be avoided and that lampholders should be constructed of, or shrouded in, insulating material so as to prevent the touching of any metal lamp-cap or lampholder plug.

All non-current-carrying metal must be earthed, except that in earth-free situations (other than conduit, sheathing and armouring, which have always to be earthed). In the tenth edition there was exemption for metal conduits when the voltage of supply was not more than 30 V AC or 115 V DC, but not for earth-free conditions. Exposed metal of portable apparatus, generally, should, even if in an earth-free situation, be connected to an earth continuity conductor in the flexible cord and to an earthing pin in a B.S. two-pole and earthing-pin plug in case the appliance is taken to a place where conditions are not earth-free.

Two-pin Reversible Plugs

The use of two-pin reversible plugs and lampholder plugs, although permissible in earth-free situations, is deprecated. Pipework in a bathroom which is electrically continuous may be employed as the uniform potential connection (provided the potential difference between any two points cannot exceed 40 V under fault conditions) and may also serve as an earth continuity conductor.

Earth-leakage protection (which may be incorporated with excess current protective devices), except as exempted, is called for in all installations. It may disconnect either the whole of the wiring or only the faulty circuit when the potential between metal and earth exceeds 40 V. It may take the form of an automatic device operating on the existence of such a potential or one which is responsive to leakage currents from metal to earth.

Exemptions are: (1) where the maximum possible earth-leakage current (based on the consumer's earth resistance alone) can be proved to be greater than the overload value for which the fuse or circuit-breaker is set; (2) where the fuse or circuit-breaker rating does not exceed 100 A and the metalwork of the system is earthed to an urban system of underground metallic water mains having metal-to-metal joints, assuming that the maximum possible earth leakage current will operate the fuse or circuit-breaker; (3) installations in which there are no exposed metal enclosures or in which all exposed metal parts are exempted from the earthing requirements.

Where an earth-leakage circuit-breaker is operated by rise of potential, its tripping solenoid may be in series with the earth-continuity conductor and direct earthing may be provided in addition. In order to avoid the possibility of the tripping solenoid being short-circuited owing to contact of metal work of the electrical equipment with extraneous metal, the solenoid can be connected by means of an insulated conductor to an electrode remote from extraneous metal and also from the main earth electrode.

Water-pipe Connections

Connections to a water-pipe used as an earth electrode should be made at the point of entry of the water service into the building, unless the pipe has only metal-to-metal screwed, compression or wiped joints or metal-to-metal bolted flanges and the resistance between any two points is such that the potential difference between them cannot exceed 40 V under fault conditions.

Additions to the section on testing are copies of forms to be filled in by the contractor on completion of an installation certifying that it complies with the I.E.E. Regulations (or if not particulars of any deviation) and after inspecting an existing installation. The period between inspections should not be longer than five years.

The number of Regulations in regard to the design and construction of electrical apparatus and cables has been reduced from forty-six to fifteen, mainly through the statement in the opening paragraph that classified materials, appliances and fittings shall comply with seventy appropriate B.S. Specifications, the titles and numbers of which are set out.

Additions to the recognised types of cables are those insulated with impregnated-jute, varnished cambric (lead-covered), varnished-cambric (non-lead covered for switchboard and other limited uses) and mineral (copper sheathed). These should generally conform to the appropriate B.S.S., but certain deviations from standards are permitted. Recognition of homogeneous tough-rubber cables awaits consideration of a B.S.S. now in preparation.

For connection to immersion and other heaters the use of one of four types of flexible cords is stipulated according to temperature and humidity. Other flexible cords are to comply either with B.S.S. No. 7 (except as regards the covering of the earth continuity conductor), or with one of two alternatives put forward.

At the end of the eleventh edition there are eighteen tables as against twenty-two in the tenth. Those omitted are: flexible cords (dimensions), test voltages, insulation resistance (cables), insulation resistance (flexible cords). Current ratings of cables and bare conductors are calculated from full-load experimenttal data provided by the Electrical Research Association and are based upon temperature rises of 30 deg. F. for v.i.r. cables, 70 deg. for impregnated-paper, varnished-cambric and impregnated-jute cables and 100 deg. for bare copper conductors.

Cable Temperature Rise Greater

The temperature rises for the cables are greater than those given in the previous edition when the two values were 20 deg. and 50 deg. F. Also, the temperature taken for the ambient air is now 90 deg. as against 100 deg. and the current-ratings of the various sizes of cables have been raised appreciably.

In the table setting out the minimum capacity of conduits for drawing in v.i.r. cables, runs not exceeding 14 ft. between draw-in boxes which do not deflect from the straight by more than 15 deg. are differentiated from runs that have a greater angular deflection.

There are now three appendices (instead of five). The first is a list of B.S.S. referred to in the main body; these number sixty-eight—an increase of thirty-one. The other two give the B.S. graphical symbols of interior electrical installations and current ratings for single-core cables run in conditions different from those in the foregoing tables. The two appendices which appeared in the tenth edition, but which have not been repeated specified the tinning test for wires and insulating materials for switchboard bases. An index of twenty-five pages compares with one of sixteen in the previous edition.

Fan Testing

THE long-awaited code for testing fans for general purposes has now been issued as B.S. 848-1939. It should go a long way towards settling present doubts and confusions. Test methods have been set out and so designed that a true picture can be obtained of the performance of a fan.

It is hoped that the new code will result in the performance figures given by the various fan makers in tenders and catalogues being strictly and directly comparable. Sections are included covering the terms and definitions in general use in the industry, precise instructions as to the types of instruments to be used in testing, general instructions for the measurement of air flow suitable for fan work and, finally, a detailed code for carrying out performance tests on certain specific types of fan. It is expected that the number of fans outside the classified types included in the Specification will be very small indeed.

The new code also includes the details of the methods for correcting and plotting the test results, and in an appendix are lists of the data required by a fan maker to prepare his tender and those he should supply to the buyer when tendering.

The code does not cover the testing of mine fans, for which a separate specification (B.S. No. 707) is issued, nor the testing of air compressors working above 1 lb. per sq. in., for which a separate specification is in course of preparation.

Copies of this new British Standard (No. 849-1939) can be had from the British Standards Institution, 28, Victoria Street, London, S.W.1 (2s. each or 2s. 2d. post free).

Copper Conduit and Fittings

A NEW British Standard Specification, No. 840, for light-gauge copper or copper-alloy conduit and fittings for electrical wiring, prescribes the quality of the copper or copper-alloy from which the conduit should be made, and gives details of manufacture and tests. A table has been included which compares the inside and outside dimensions of copper conduit as against those for steel conduit covered by B.S. 31. Conduit boxes, if made of copper or copper-alloy, are required to comply with the dimensions laid down in B.S. 31.

In order that steel, malleable or cast-iron boxes may be used with copper conduit details of suitable couplers are also given. The specification also gives details of other copper fittings, such as saddles, clips, &c., which differ slightly from those used for steel conduit on account of the slight differences in external diameter of the copper and steel tubing. Copies of this new British Standard may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

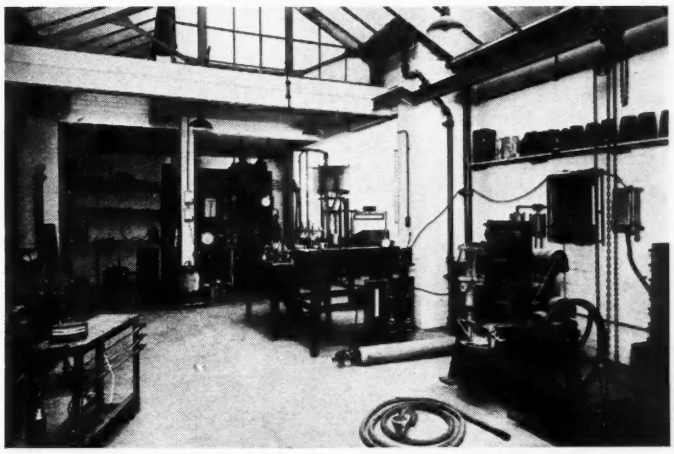
NON-FERROUS METALS

New Research Laboratories

AN important addition was made to the resources of the British Non-ferrous Metals Association on June 29th, when the Rt. Hon. Oliver Stanley, President of the Board of Trade, opened new research laboratories in Euston Street, N.W.1. The new building consists of semi-basement, ground and two upper floors occupying a site 90 by 50 ft. immediately adjacent to the older laboratories (dating from 1930) and brings the total laboratory floor space up to about 20,000 sq. ft.

A favourable impression of the general layout is at once produced by the provision made for the various utility services. A covered trench, 2 ft. 6 in. deep, runs around and close to the four main walls of the semi-basement. From this trench vertical ducts run within the external walls (two in each window pier) to the full height of the building, supplying the various rooms on the way.

Electricity is taken at 400-230 V from the three-phase mains through a 500-A triple-pole and neutral oil circuit-breaker situated under the entrance hall.



Part of the melting shop, showing the high-frequency furnace

Distribution boxes and fuse boards at the foot of the running ducts in the basement allow for future connections to be made with the minimum of disturbance. DC is required at 220 V in the Physics laboratory and at 440 V in the mechanical testing laboratory and is obtained *via* an 11-kW hot-cathode rectifier.

Heating is by coils of copper pipe embedded in the ceiling and fed with water at from 90 to 110 deg. F. from boilers with electrically operated automatic stokers. Space considerations permitted the installation of air-conditioning plant only for the constant-temperature room of the mechanical testing laboratory. This room (480 sq. ft.) is maintained within ±½ deg. of 68 deg. F. and no two points in it differ in temperature by more than 1 deg.

Air drawn through a box containing four electric heaters and a cooling element (served by a 3-HP refrigerator) is propelled by a fan through a trunk for the length of the room at ceiling height. Return air is drawn from near floor level and is deflected in the return trunking so as to operate five thermostats (one controlling the cooling and four the heating elements). Air loss is made up and ventilation is provided by taking about 20 per cent. of the circulating air from outside. Fumes from the chemistry laboratories and the galvanising and welding shops are removed by extraction systems.

Electric Furnaces

Extensive use is made of electricity in the melting shop, where, in addition to several wire-wound electric furnaces made by the staff, there are three for heavier duties. The first of these is a 27-kVA "Efco" furnace using non-metallic resistor rods (silit) which has a capacity of 120 lb. of copper and goes up to over 2,250 deg. F. A Scott-connected 3/2-phase transformer steps down from 400 V to voltages from 65 to 135 by means of five off-load tappings. The sixteen resistors are in eight circuits and a "Sunvic" bimetallic-strip thermostat maintains the energy input constant by cutting the transformer in and out.

Another "Efco" unit, rated at 35 kVA, is installed for high-frequency melting. It is of the spark-gap type and is made up of three separate furnaces with capacities of 22, 11 and ¼ lb. of copper. A fourth furnace coil is built into a small equipment constructed in the Association's workshops for melting charges of copper up to 2 lb. in vacuo or in controlled atmospheres. The high-frequency generator is supplied through a tri-mono transformer which enables the single-phase converter load to be connected to the three-phase four-wire system with a partial balance in the ratio of 1:2:1.

The third main furnace is a 21-kVA Birlec annealing furnace with a hearth of 32 by 20 in. fed from the main supply through a transformer at 146 V. By virtue of Cambridge thermostatic control a constant temperature up to over 1,800 deg. F. can be maintained.

Apart from the melting shop is a laboratory for the heat treatment of smaller specimens, in which are a furnace with non-metallic resistors, a thermostatically controlled wire-wound furnace and two thermostatically controlled electric ovens, one for temperatures up to 650 deg. F. and the other up to 300 deg. F. Smaller furnaces are in use for experimental work on oxidation and scaling in special atmospheres. Cambridge thread-recording millivoltmeters are in use for temperature measurements here and elsewhere.

The mechanical testing laboratory which occupies the whole of the working space (2,800 sq. ft.) of the new semi-basement contains complete equipment for tensile, hardness, impact, fatigue, cupping and creep tests. Many of the machines were designed and constructed in the Association's workshops. In the machine shop individual drive by three-phase motors has been adopted. Among the lathes is one of the 6-in. Holbrook high-speed precision type with a speed range of from 30 to 1,500 RPM.

About 900 sq. ft. of floor area is allocated to the physics laboratory, where spectrographic analysis is undertaken for determination of minute impurities (down to 0.0001 per cent. of bismuth in copper, for example, can be detected) when chemical analysis would be difficult or tedious. Three sizes of Hilger spectrographs and a non-recording photometer are in use. Both DC arc and AC spark equipment is available. Here measurements of electrical resistivity by a Tinsley Kelvin double bridge and of thermal conductivity by apparatus made in the laboratories are among the various activities. Micro-examination and metallographic preparation of specimens have been well planned as essential adjuncts.

Some of the most important work in hand is on corrosion, and at the time of our visit 490 tests were being carried out on 45 different materials under 50 different conditions. One of the most interesting of these was to determine the resistance of condenser tube materials to attack by jets of aerated sea water at 15 ft. per sec. An important subsidiary function of the Association is to keep its members in close touch with technical progress. Through its library and information and development services data published in the technical Press and elsewhere is immediately notified to those likely to be interested.

Opening Ceremony

At the opening ceremony the President of the Board of Trade unveiled a bronze plaque portrait of the late Mr. Thomas Bolton, who was chairman of the Association from its inception in 1920 until 1937. He was succeeded by Lt.-Col. J. H. M. Greenly, with whom are associated Dr. H. W. Brownsdon and Messrs. R. Ll. Gibbins, W. M. Morrison and A. H. Wolseley among the vice-chairmen. Members of Council include Dr. W. E. Alkins, Dr. R. W. Bailey, Dr. F. J. Brislee, Lt.-Gen. Sir J. E. Charles, Mr. P. V. Hunter, Dr. C. C. Paterson, and Messrs. P. Pritchard and A. J. G. Smout. The Director of the Association is Dr. H. Moore, who is assisted by a staff of more than sixty, including twenty-five senior technicians. The membership now comprises nearly 300 industrial concerns, and the income exceeds £30,000 per annum, about one-third of which is furnished by the Department of Scientific and Industrial Research. Messrs. Munby & Smith were the architects, and the electrical advisers were the General Electric Co., Ltd., which also supplied electrical fittings. The general contractors were John Greenwood, Ltd., and Drake & Gorham, Ltd., supplied electrical fittings; Frigidaire, Ltd., air-conditioning plant; and Keith Blackman, Ltd., fume extraction plant.

FRICTION IN METERS

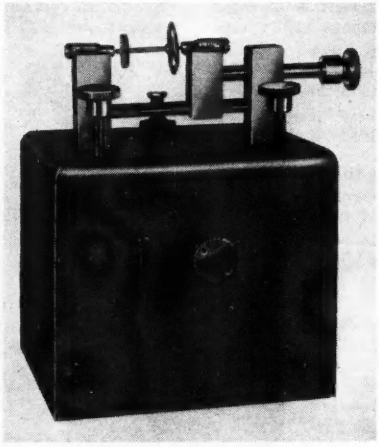
Results of Investigations

By E. Roscoe, A.R.T.C.(Salford), A.M.I.E.E.

THE Electricity Supply (Meters), Act, 1936, was introduced, to quote the Act itself, "to make better provision for the measurement of electricity supplied by authorised undertakers." One advantage is that the examiner during his regular visits helps to collaborate in ideas and methods, and his visits have introduced an additional test on samples of meters certified to those already taken.

The accuracy with which his results agree with the figures submitted has come to be regarded as a gauge of the quality of the testing. Consistency of error and minimum error have always been a problem to the meter engineer. With some modern meters this presents little difficulty, especially when temperature compensation is provided.

One major cause of variation is friction, and it is therefore more marked at lower loads and in older types of meters. The Lancashire Electric Power Co. found a certain old type of meter removed from service to be inconsistent on 5 per cent. load. Endeavours were made to overcome this difficulty by changing the worm, spindles and pivots. The original worm was made of brass and double the diameter of the new one, which was cut in the spindle. The pivot was of a different shape and increased the pressure from 20 tons per sq. in. to 50 tons per sq. in., which one would expect to shorten the life of the pivot and jewel.



Machine for testing worm wheel balance

In order to fit the new spindles, it was necessary to do a fair amount of cutting and filing and to dismantle the meter.

TABLE I

	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Average per cent.
With trains ...	0.9	1.9	0.6	1.8	1.0	0.9	1.2
Without trains ...	0.4	0.4	0.2	0.2	0.0	0.1	0.2
	*0.1	*0.1					0.1
Driving worm wheel only	0.8	0.3	0.5	0.9	0.7	1.2	0.7
Driving worm wheel and 1/100 wheel...	0.8	2.2	0.5	1.3	1.3	0.9	1.2

Percentage variation in error in six tests at 3 revs. each, K = 125.2 sec.
* After changing top pins.

Filing of meter parts is always to be avoided, as it is difficult to remove all filings to prevent them from appearing later in the gaps. Dismantling upset the calibration, which was within fairly close limits when the meters came in from circuit. The cost of carrying out the above change was high, and it was thought advisable to carry out experiments to see if this variation could be reduced by any other means. With this end in view, the following tests were made.

Initial Test

Six meters were taken and after being off-circuit tested, they were cleaned and overhauled, but the new spindles were not fitted.

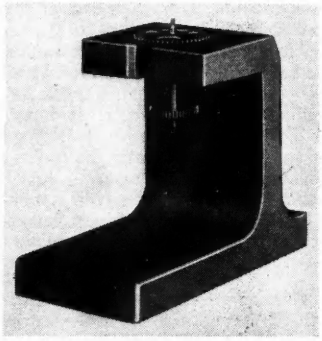
The average variation taken over six timings at 5 per cent. load was found to be 1.2 per cent. The counting train was taken out of mesh and the meters were found to be consistent when the disc was not driving the train. The worm wheel was put into mesh again with the worm, but the $\frac{1}{100}$ wheel and pointer were removed so as to drive the worm wheel only; an average variation of 0.7 per cent. was found. The $\frac{1}{100}$ wheel and pointer were replaced and $\frac{1}{10}$ wheel removed; the average variation of the same number of timings was 1.2 per cent. (see table I).

Thus it found that the friction in the first two wheels only affected the speed of the meter, and that approximately 60 per cent. was in the worm wheel and 40 per cent. in the $\frac{1}{100}$ wheel for the particular ratio. Attention to bearing surfaces and polish of spindles of these two wheels is important, and they should, in my opinion, be jewelled, and could be at little additional cost. An alternative which might be considered is the use of a small ball-race, which is made in sizes from 1.5 mm.; samples of this have been purchased for further investigations.

Spindles and Bearings

Another factor which comes into the question of reducing friction is that of keeping down the pressure between the spindle and bearing surface. In heavier engineering, it would be considered absurd to drill a hole in a piece of brass and put into it a steel shaft which was polished, let alone semi-polished, such as is often found in meter trains.

Much time is usually spent in bedding by marking and scraping in heavy engineering in order to increase the area of contact to a maximum and therefore the pressure to a minimum. If this is not done, heating occurs in use, because the prime mover has sufficient power behind it to generate this heat energy. In the case of a meter, the pressure may be the same as in heavy engineering, but the meter will slow down if there is friction present and readily dissipate the minute quantity of heat generated. It is, therefore, equally important to keep the pressure between the spindle and bearing down to a minimum in meter trains. The spindles should be polished and the bearings finished by drilling undersize and then reamered to the correct size. Lastly, but of primary importance, moving parts should be made as light as possible by using materials of a low specific gravity. This has a double advantage which will be seen from tests described later.



Drilling stand for wheels

TABLE II.

Position of reference diameter deg.	(a) Test number				Max. variation per cent.	(b) Test number				Max. variation per cent.	(c) Test number					Max. variation per cent.
	1	2	3	4		1	2	3	4		1	2	3	4	5	
0	1.8+	1.6+	1.8+	1.7+	0.2	2.5+	2.7+	2.6+	2.8+	0.3	14.3+	14.6+	14.6+	14.5+	14.5+	0.3
90	0.7+	1.0+	1.3+	1.4+	0.7	1.7+	1.8+	2.0+	1.9+	0.3	14.1+	14.1+	14.1+	13.8+	13.6+	0.5
180	0.6+	0.7+	0.9+	1.1+	0.5	1.8+	2.1+	1.9+	2.3+	0.5	14.3+	14.0+	14.4+	14.0+	14.0+	0.4
270	1.1+	1.2+	1.0+	2.0+	1.0	2.7+	2.5+	2.5+	2.5+	0.2	15.0+	15.0+	15.1+	15.0+	14.6+	0.5
Maximum variation, per cent.	1.2	0.9	0.9	0.9	—	1.0	0.9	0.7	0.9	—	0.9	1.0	1.0	1.2	1.0	—

(a) Worm wheel only driven; pivots unpolished. Average maximum variation for any given position 0.6 per cent. and for each test 1.0 per cent.
(b) Worm wheel only driven; pivots polished, but not bearings. Average maximum variation for any given position 0.3 per cent. and for each test 0.9 per cent.
(c) Worm wheel only of second meter driven. Average maximum variation for any given position 0.4 per cent. and for each test 1.0 per cent.

The next test was to investigate the effects of different positions of meshing of the worm and worm wheel. One of the meters had its worm wheel ("O" wheel) marked at four positions 90 deg. apart. Four timings were taken at each position, only the worm wheel being driven (table IIa), with the result that the average maximum variation for any given position was 0.6 per cent., while the average maximum variation for the four different positions was 1.0 per cent.

As the polish on the spindles was not very good, the test was repeated after polishing (table IIb) with the result that the average maximum variation for a given position was reduced by 50 per cent., but by only 10 per cent. for different positions of meshing. If the bearings also had been polished the effect might have been even more pronounced. At this stage another meter was chosen from the six and five similar tests were carried out (table IIc.) Comparison with table IIb shows that the two meters were very similar in their characteristics.

TABLE III

Position	(a) Test number		Max. variation per cent.	(b) Test number			Max. variation per cent.
	1	2		1	2	3	
Spot being driven upwards	2.5+	2.5+	0	2.6+	2.6+	2.5+	0.1
Spot being driven over top	3.1+	—	—	2.6+	2.8+	2.9+	0.3
Spot being driven downwards ...	3.6+	3.4+	0.2	2.8+	2.5+	2.8+	0.3
Spot being driven under bottom ...	3.0+	—	—	3.1+	2.8+	2.8+	0.3
Maximum variation, per cent.	1.1	0.8	—	0.5	0.3	0.4	—

(a) Worm wheel only of second meter driven, with spot on heaviest part of wheel. Average maximum variation with a fixed position 0.1 per cent. and with different positions 0.9 per cent.
(b) Worm wheel balanced by drilling holes on spotted side. Average maximum variation for a given position 0.2 per cent. and for different positions 0.4 per cent.

Microscopic examination of the wheel did not reveal the cause of higher maximum variations in one direction than the other. It was suspected that the wheel might be out of balance, and that the meter was lifting a greater weight in one position of meshing than the other. The wheels were tested for balance and the heaviest part was marked with a spot without informing the tester whether this indicated the lightest or heaviest part of the wheel.

Tests were taken with the spots rising, falling and moving horizontally (table IIIa). It was found that when the spot was rising and the heaviest side of the wheel was being lifted, and therefore the friction between worm and worm wheel was increased, the meter slowed down. The worm wheels of three meters were now balanced by drilling holes on the heaviest side, and the last test was repeated (table IIIb) giving a maximum variation for all positions of the worm wheel of 0.4 per cent., and of 0.2 per cent. at any given position.

These results clearly indicated that the cause of the trouble was out-of-balance of the worm wheel, and that consistency could not be obtained until this defect had been remedied. A small machine was designed which can balance these wheels at the rate of twenty to thirty per hour, and this or some other substitute is indispensable to the meter repairer and tester.

The $\frac{1}{100}$ wheel also has a slight effect due to out-of-balance, but it is useless to correct this until a balanced pointer has been fitted. The effect of out-of-balance was tried by drilling 0.018 gramme at a distance of 0.5 cm. from the centre of the worm wheel spindle, the wheel being previously balanced. The effect of this was to cause the meter to slow down by 0.5 per cent. at 5 per cent. load when the heavy side of the wheel was being lifted.

The worm wheels of all six meters used during this test were balanced and the meters calibrated, the average maximum variation due to position of meshing was 0.4 per cent. at 5 per cent. of full load on the meter, and 0.7 per cent. at 2½ per cent. of full load. Considering that these meters were ten to fifteen years old, the results were very satisfactory. The meters were put forward for certification by the examiner, who was not aware that they had not had the spindles changed in the ordinary manner. The meters were tested against the examiner's 12-in. wattmeter, and the maximum difference between the figures obtained and those submitted was 0.7 per cent., and this on one meter only, all others being within 0.3 per cent.

The results of this investigation will be to reduce considerably the cost of repairing at least this type of meter, to put out on circuit a measuring device that is more consistent than when it was bought many years ago, to save time in calibrating off-circuit meters which are nearly within the limits and require little adjusting, to obviate the necessity of filing and running the risk of getting these filings in magnet gaps, and to save expenditure on new parts except those worn by service.

Depth of Meshing

Investigations are being made into the effect of depth of meshing of worm and wheel by means of a projection lantern. It can be said that undermeshing is preferable to overmeshing, and that when the lightest portion of the wheel is in mesh with the worm, the wheel falls forward so as to be out of contact with the worm altogether.

The evidence points to the conclusions that the first two wheels of a meter train should be balanced where the spindles of these are horizontal, that a high degree of polish of bearing surfaces of these spindles is necessary, that the $\frac{1}{100}$ pointer should be balanced, that weight of moving parts should be as low as may be consistent with rigidity and robustness (as this has the double advantage of reducing friction and minimising the effect of any out-of-balance) and that reducing the diameter of the worm reduces the frictional effect but does not remove the cause of the trouble of varying friction.

In conclusion I wish to express my thanks to the management of the Lancashire Electric Power Co. for permission to publish information collected in its testing laboratory during my ordinary duties.

Progress at Leeds

INCREASES of 6.4 million kWh in sales and 5,073 in the number of consumers are recorded in the annual report of the Leeds Electricity Department for the past year, making the respective totals (which relate to the distribution area only) 261.4 million kWh and 159,607 consumers. Omitting the consumption for traction and street lighting, the energy sales were equivalent to 447 kWh per head of the estimated population of 494,000, compared with 434 kWh per head of a population of 491,880 in the previous year.

Principal development was in power sales, which rose by 5.9 per cent. to 114.6 million kWh, a very satisfactory record under the prevailing conditions. The total capacity of motors connected increased from 135,676 to 140,535 kW, and the sales per kW installed improved from 806 in 1937-38 to 827 kWh last year.

The next largest consumption was under the "residential bulk supply" (or two-part) tariff, to which there was a further notable accession of consumers (11,129), making the total number 77,459. The increase in sales under this tariff of 2.9 million kWh (5.4 per cent.) was not so large as in the previous year and was offset by a decrease under the lighting rate, from which more consumers were transferred than in 1937-38. On the other hand, there was a larger growth in the capacity of consumers' apparatus than before, which rose by 30,393 kW to 236,553 kW, so that the sales per kW installed declined from 283 to 259 kWh.

Supplies for traction—at the low price of 0.370d.—totalled 38.8 million kWh, a decrease of 1.4 million kWh, which reduced the improvement in sales in the distribution area to 2.5 per cent.

The amount of electric street lighting was appreciably extended, supplies for this purpose rising by 25 per cent. to 1.8 million kWh.

During the year the simultaneous maximum load on the Kirkstall and Whitehall Road stations (operated in parallel) was 142,260 kW, compared with 126,120 kW in the previous year. At Kirkstall 330.6 million kWh was generated with a coal consumption of 1.314 lb. per kWh, while the Whitehall Road station generated 108.6 million kWh with a coal consumption of 2.226 lb. per kWh.

The income of the Department from all sources increased by £17,164 to £1,116,253, but working expenses rose by a larger amount—£54,337—to £599,190, and as loan charges, income tax, &c., were also up the net profit was reduced from £90,491 to £38,842. A sum of £46,440 was required as a contribution to capital expenditure, so that there was a final deficit of £7,598 compared with a profit of £27,145 in the previous year.

The net prices received per kWh from the different classes of consumers were as follows, with previous year's prices in parentheses: Power 0.631d. (0.621d.); private lighting (ordinary), 1.981d. (2.024d.); private lighting (prepayment), 3.504d. (3.501d.); street lighting, 1.250d. (same); heating, 0.823d. (0.794d.); and residential bulk supply, 1.072d. (0.962d.). The receipts from the showrooms and installation and hire departments increased satisfactorily during the year from £20,383 to £23,272.

On October 26th the death occurred suddenly of Mr. C. Nelson Hefford, the city electrical engineer and manager, and Mr. E. Porter, chief assistant engineer, was appointed acting executive head early this year. Mr. F. Nicholls (Derby) was later appointed to succeed Mr. Hefford.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Cooker Hire at Ashton

IN the Electricity Supply Notes in your current issue there is a notice under the heading of Ashton-under-Lyne stating that our cooker hire scheme is being withdrawn, but this is not correct.

We have decided not to purchase any further cookers for simple hire, but this does not mean that we are giving up the hiring of cookers. We shall still continue to hire from our present stock, and in future new cookers of the "streamline" type will be purchased only for sale to consumers on credit sale agreements.

P. BREGAZZI,
Ashton-under-Lyne, *July 3rd.* Engineer and Manager.

Voltage Standardisation

Mr. E. P. Burdett in his letter in your issue of June 16th suggests that a change of pressure from 240 to 230 V would be an unjustifiably costly matter involving an extensive system of new cables and sub-stations at an expense, for the size of undertaking he cites, of over half a million pounds.

The only part of his letter with which I fully agree is his statement that the capacity of low-voltage network cables is usually limited by voltage drop. This means that if the voltage drop between network sub-station and the most remote consumer is already limited by the undertaking's policy to, say, 6 per cent., it would only be increased by 0.48 per cent. of the declared voltage by the reduction from 240 to 230 V.

I suggest that such a very small increase in maximum voltage drop to the most remote consumers is not a matter calling for an extensive system of new cables, and that the great majority, if not all, of the existing sub-station networks would be quite adequate for the new conditions. If any were not adequate it is clear that they must be due for strengthening in any case as a result of the rapid growth in load which is being experienced almost everywhere. I believe, however, that most of the networks which have been laid down in recent years are designed with the idea that when they become overloaded the situation will generally be met by installing additional sub-stations rather than by strengthening the low-voltage network.

As regards transformers in network sub-stations, it is usual to have 2½ and 5 per cent. or other small percentage tappings on these for voltage adjustments and with the aid of these tappings and a very slight alteration of the high voltage it should be quite feasible to avoid any considerable renewal of transformers.

If an undertaking had to make the change at its own expense I believe that it would be carried out cheaply on the lines suggested above. On the other hand, if the change were made at the expense of the industry or the taxpayers it is quite possible that the cost would approximate to Mr. Burdett's figure.

L. ROMERO,
Salford, July 3*rd.* City Electrical Engineer.

Explanation Wanted

The pivot of the problem stated that "Puzzled is, I think, the carrying capacity of the mild-steel conduit and this is not known. The metal was evidently incapable of completely discharging the current to earth in time to avoid arcing before the fuses blew. There must have been a considerable amperage to sustain an arc big enough to burn through a "compo" gaspipe and ignite the gas.

If the compo pipe has a lower resistance to earth then a good proportion of the fault current would be diverted through it. As the compo pipe was presumably in close contact with the conduit (but not necessarily in perfect electrical contact) the resistance to the striking of an arc could not have been very high. I imagine that the point of arcing was not far away from the short-circuit.

The Mines Department Handbook (M. & Q. Form 11) requires that the metallic covering of a cable should have, throughout its length, conductance at least half that of the largest working conductors in the cable, the inference being that in the event of a dead short the earthing conductor would carry momentarily at least half the current carried by the largest conductor.

There is another possible explanation, but this I regard as more remote. "Puzzled" mentions that two separate services are installed in separate parts of the building, the conduit of one being bonded to a water main and of the other to the supply undertaking's armoured cable. If the gas main is near the electric main in damp ground, and if there is any DC leakage of opposite polarity to that of the conductor which was accidentally earthed, this might have been the cause of the arc.

The practical object of earthing is, according to the Mines Department Handbook, the prevention of a dangerous difference of potential between the earthed metallic body and the ground or other metallic bodies in contact therewith. Earthing alone, it is stated, will not achieve this, except as against an electrostatic charge or where there is only one fault upon the system and no other point of the circuit is connected to earth.

If there are faults upon two poles of the system, or if one pole or the neutral point of the system is earthed, then while fault current is flowing in the earthing conductor, its potential will differ from that of earth, by an amount determined by the product of the fault current and the resistance of the earthing conductor including that of the earth plate if comprised in the fault circuit. If an earth fault occurs the circuit which is affected must be isolated automatically and without delay.

In his first letter "Puzzled" asked how he could carry on with the wiring system without removing the gas pipes. This procedure seems to be full of danger. What can prevent a similar breakdown happening again? Not only is there a risk of another fire, but there will always be the risk of electrolysis from stray currents on a DC circuit.

The risk might be lessened by bonding everything together at several points both conduit services (now separately bonded to earth) and gas pipes included, but I.E.E. Regulation 1006B prohibits this. A loophole is apparently left in Regulation 1002B which permits the bonding of all exposed metalwork by means of a separate earth continuity conductor. Why not run this to bond together the conduit and gas pipe in addition to the existing bonding of the conduit system. No serious potential difference could then occur between the conduit and the gas pipe.

Whatever "Puzzled" decides to do after again testing the wiring system, the conduit and the gas pipe, he should consult the fire insurance company which may decide the problem for him by refusing to allow the further use of the existing system until the gaspipes are removed.

H. YOUNG.
Hove, *June 27th.*

Meter Charges

In the House of Commons recently the Member for Evesham is reported as having said, in connection with the Bill he is introducing to abolish meter rents: "The grocer and the butcher do not charge for the scales with which they weigh out their goods to the customer. The retail distributor does not charge for the carriage of goods to the customer. All such charges are part of the overheads of the business."

If the hon. member, however, required his grocer or his butcher to keep a certified pair of scales for weighing his requirements *alone*, would the hon. member expect such a retailer to provide the special scales free of charge?

If such a retailer were required to keep a certified pair of scales in the house of each of his customers so that on delivery the weight could be checked, the retailer would either have to increase the charges for his goods or make a charge for the provision of the special scales.

C. CULMER HODGES, M.I.E.E., A.M.I.MECH.E.,
Chief Engineer and Manager, St. Austell & District Electric Lighting & Power Co., Ltd.
St. Austell, *June 29th.*

Battery Sales in Canada

SALES of electric storage batteries and parts by Canadian producers were valued at $844,172 during the first quarter of 1939 as compared with sales of $944,224 during the first three months of 1938. This quarter's output included 147,512 batteries at $618,347 for internal combustion engine starting and ignition, 501 batteries at $1,508 for motor cycle starting, 2,751 cells at $16,101 for farm lighting plants and 842 cells for $15,056 for railway car lighting and signal service. Imports of electric batteries of all kinds were valued at $67,733 and exports at $66,150 during the period as compared with $57,449 and $79,649 in the corresponding quarter of 1938.

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Portable Floodlight

IN places where a naked light is dangerous and no electricity supply is available a useful substitute is the "Croydon" portable floodlight. (BOWTHORPE ELECTRIC CO., LTD., Purley Way, Croydon).

The double jointed extension arm is 5 ft. 6 in. long and the ball joint at the end enables the light to be projected in almost any direction. An 18 W lamp is fitted and a spare lamp is housed in a metal-covered box.

The extension arms and reflector can be folded neatly down to the top of the case. The unit weighs 28 lb. The finish is grey, the reflector being sprayed in white.

"Croydon" portable floodlight

Small Resistances

ELECTRONIC ENGINEERING SERVICES, LTD., Swakeleys Road, Uxbridge, announce the introduction to the British market under the trademark "Omco" of vitreous enamelled resistances made by the Ohmite Manufacturing Co., Chicago.

Type "VV" is a rheostat potentiometer having the fine control of a wire-winding together with vitreous enamelling to prevent loosening of the turns. Silver graphite or copper graphite brushes, with pigtail connections, ensure long contact life, while the rotary toroidal design results in compactness and ease of control. Ratings are from 25 to 1,000 W, in resistance values from 0.5 to 10,000 ohms. Tapered windings are available up to six sections.

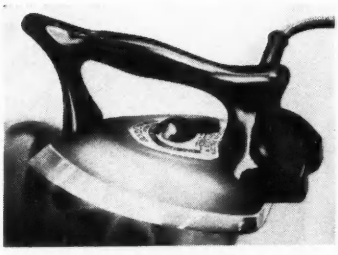
The "Dividohm" units are capable of accurate preset adjustment, for example, during production testing. These are vitreous enamelled all over except for a narrow base strip which allows contact with a ball-faced sliding contact clip to prevent variation of resistance by short-circuited turns. These units are available from 10 to 200 W in 5 to 10,000 ohm ratings.

Other products include "VF" vitreous enamelled resistors from 10 to 200 W and 1 to 250,000 ohms and the "Corribs," a heavy-current resistance unit, having corrugated ribbon wound on the edge on a porcelain core, the whole assembly being vitreous embedded.

Heat-controlled Iron

A new automatic heat-controlled iron is the "Glydomatic" of BEETHOVEN ELECTRIC EQUIPMENT, LTD., Chase Road, North Acton, London, N.W.10.

The plated soleplate is tapered and chamfered and the body is vitreous enamelled in black or cream. The handle has air vents at the front and back to keep it cool and a finger-tip regulator gives correct ironing temperatures for artificial silk, silk, wool, cotton and linen. Nine feet of non-kinking flex is provided. The weight of the iron is 5¼ lb. and the element is loaded at 750 W. The design of the thermostatic control makes it suitable for AC only.



"Glydomatic" iron

A.R.P. Lighting

"Traffotslak," a system of lighting developed by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 17, enables work to be carried on in factories with large areas of glass windows or roof lights by day and night without danger of being seen by enemy aircraft.

The scheme is based on the use of artificial light sources emitting light of a certain colour and the spraying of all glass with a lacquer which allows daylight to penetrate but does not pass the light from the special lamps.

A new type of electric-discharge lamp requiring the usual control equipment and producing an efficient monochromatic light is used. It also has the advantage of providing several times the light output of a clear gasfilled lamp of equal wattage.

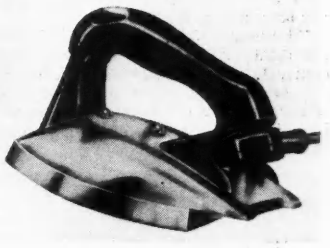
The window lacquer has been designed, after extensive photometric tests, to ensure that while a maximum daylight infiltration is allowed complete obscuration takes place at night. It is, of course, essential to confine all night-time illumination during an air raid to that from the special lamps.

New "Streamlined" Iron

The REVO ELECTRIC CO., LTD., Tipton, Staffs, has introduced a "streamlined" electric iron known as the "Comet" at a low price.

The iron has a particularly attractive appearance, the sole plate and two metal handle supports being chromium-plated and the wooden handle shaped with a thumb groove. The base, which is foreshortened in the accompanying illustration, has bevelled sides to slip under buttons and a tapered point for pleats.

The element is loaded at 500 W and a special feature is the placing of the connector under the back of the handle.



"Comet" iron

Arora infra-red projector

Infra-red Projector

The ARORA CO., Loughborough, has brought out a small infra-red projector for home use. It is mounted on a stand but can be removed from the base and used in the hand. A dual adaptor is provided giving a lampholder connection and two-pin plug with a switch in the cord.

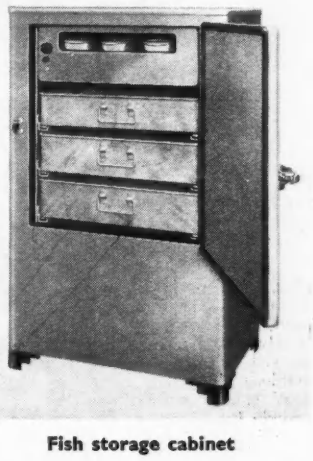
The same concern is producing a fire designed to meet the competition of large stores offering cheap fires. This appliance is rated at 750 W and is equipped with a chromium-plated reflector in a surround of blue, green or buff.

Fish Cabinet

A refrigerated cabinet for 10-12 stone of filleted fish is one of the more recent products of the PRESSED STEEL CO., LTD., Cowley, Oxford.

Two separate coils are employed; one set at the top serves to provide 7½ lb. of ice in sixty cubes at one freezing, while the second coil round the main cabinet keeps the fish at a temperature of between 33 and 35 deg. F., with a humidity of 95 per cent. The ice cave, where the cubes are made, is maintained at a temperature of between 5 and 10 deg. F.

The cabinet is made of rustproof steel with rounded corners and a flat top, the exterior finish being an aluminium pigmented lacquer. Galvanised steel is used for the interior of the cabinet and a special draining arrangement removes any water which collects at the bottom of the cabinet.



Fish storage cabinet

D

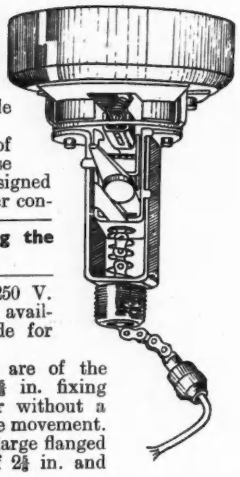
The three galvanised fish drawers are fitted with inclined, loose, non-perforated bottom trays which ensure that the fish is properly drained yet not marked.

The overall dimensions are, height 53 in., width 28½ in., and depth 20½ in., and the motor is rated at ½ HP.

Ceiling Switches

The new "Landor" q.m.b. ceiling switches just introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, incorporate a new oscillating see-saw mechanism and are fitted with roller link chain and single cord pull. While giving the same service as before their design enables a considerable speeding-up to be made in the manufacturing process.

The "Landor Junior" type is of small diameter having a 2-in. base and fixing centres of 1¾ in. It is designed to fit direct to G.E.C. small diameter conduit boxes and is rated at 3-A, 250 V. Surface and semi-recessed types are available and bakelite flanges are made for the semi-recessed pattern.



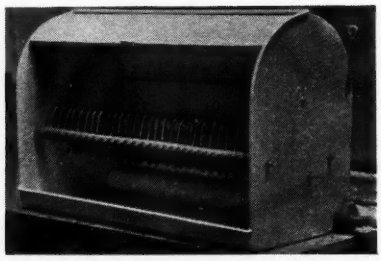
"Landor" ceiling switch showing the mechanism

"Landor" 5-A, 250-V switches are of the standard size (2¼ in. base and 1⅝ in. fixing centres), and are supplied with or without a rubber silencing buffer to quieten the movement. The new series is completed by the large flanged base type which has a diameter of 2⅝ in. and fixing centres of 2 in. It is rated 5 A, 250 V and is designed to fit direct to B.S.S. conduit boxes. Bakelite flanges are also suitable for this large base type switch. All these new switches are available with metal or all-insulated covers, the former being supplied in polished brass, bronze colour, oxidised silver or chromium plated.

Plate Warmer and Dryer

The latest development by H. W. RODDA & Co., Churton Place, Churton Street, London, S.W.1, is an electrically heated rack for crockery in an attractive stove-enamelled welded sheet-steel cabinet.

The purpose of the unit is two-fold. It can be used to house the crockery in the ordinary way, the electric heater being used for warming plates. Also by placing washed crockery on the rack drying is effected rapidly when the heater is on.



Rodda crockery dryer and warmer

The capacity is 32 plates, all resting on rubber-covered bars. In addition, cups, jugs and even food can be kept warm on the bottom shelf. The cover slides back to give accessibility to crockery, and the overall measurements of the apparatus are 24 in. long by 16 in. high by 12 in. deep.

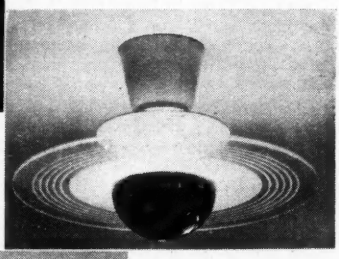
New Lighting Fittings

DURING the past few weeks a number of new lighting fittings have been placed on the market. The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has produced a new range of fittings for domestic purposes, two of which are illustrated below. There are new hall fittings and pendant bowls, a number of ceiling units of modern design, candle type pendant fittings, wooden pendants and wall brackets. The "Danfych" (illus.) is a champagne or pink glass ceiling fitting, 12in. in diameter, with silver lines, the metalwork being in antique brass or chromium plate. The "Silwin," also has champagne glass with red and clear line decoration. The metalwork is available in chromium plate, antique brass and satin silver.

Two G.E.C. fittings — Above; "Danfych"; Right: "Silwin"

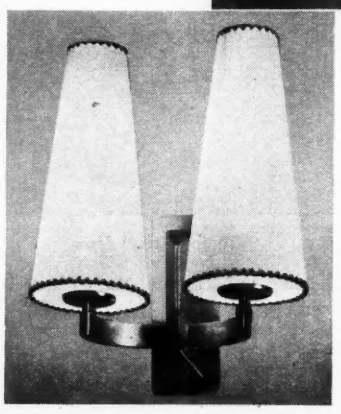
A series of new fittings has also been developed recently by TROUGHTON & YOUNG, LTD., 143, Knightsbridge, London, S.W.1. The two models illustrated are the F.722 and F.784. The former is a drawn sheet glass fitting with sandblasted lines and a polished edge. There is a chromium-plated bowl, the other metalwork being sprayed with ivory cellulose. Two 8-in. 30-W candle lamps provide the illumination for F.784 and the finish is satin silver. The shades are in ivory celastoid and they can be thonged in any colour.

Another company to introduce a series of new lighting fittings is BERRY'S ELECTRIC, LTD., Newman Street, London, W.1. Those illustrated are two among several. The BE.3162 is an attractive pendant with satin gold metalwork and a glass bowl in beige, peach or green. The vertical umbrella-handle shaped decorations are made of clear crystal glass, and the fitting measures 22 in. in diameter by 27 in. long. The BE.3164 has three vertical crystal glass decorations. The metalwork is in satin gold finish, and the bowl is again available in beige, peach or green, the outer ring being clear glass slightly frosted.



Top left: Berry's Electric BE.3164; above: BE.3162

The GENERAL ELECTRIC CO., LTD., has also introduced special fittings for hospital wards. These are available in two forms, both comprising a single rod suspension with a sphere fitting. No. 5856 has a slightly flattened top and is designed for use with a 60-W lamp, the top of the fitting having provision for two additional 15-W pygmy lamps for night lighting. In the F.5818 the pilot light is concealed at the bottom of the fitting, emitting a subdued light only in the region immediately below the fitting; thus is can be used for the benefit of one patient without giving much general illumination.



Above and left: Troughton and Young F.722 and F.784

MAINS IN HIGHWAYS

Report of the Joint Committee of Both Houses of Parliament

By a Barrister-at-Law

THE Joint Committee of the House of Lords and the House of Commons on the Breaking-up of Streets by Statutory Undertakers has now issued its report (H.M. Stationery Office, price 5s.).

The appointment of the Joint Committee was the climax of some fourteen years of negotiation between the Associations of the highway authorities and the electricity, gas and water associations as represented by the Conjoint Conference of Public Utility Associations. On three occasions the negotiating committee appointed by those bodies had reached agreement, but that agreement failed to secure the confirmation of the highway associations.

The question upon which it was found impossible to agree was whether the highway authority or the public utility should bear the cost of removing mains and cables where such removal was rendered reasonably necessary by highway reconstruction. In 1938 a contest before committees in both Houses of Parliament on the consideration of the West Yorkshire Gas Distribution Bill (now an Act) resulted in favour of the public utilities.

The question has gained additional importance, not only by reason of the increasing amount of highway reconstruction work rendered necessary by the vast growth of traffic, but also by the fact that the Ministry of Transport has become vitally interested as the highway authority in the trunk roads of the country. The matter was, therefore, submitted by the Government to the Joint Committee of both Houses under the chairmanship of Lord Carnock. Before this Committee there appeared the Conjoint Conference of Public Utility Associations on the one side and the associations of the highway authorities, the London highway authorities, and the four main railway companies, together with the London Passenger Transport Board and the Canal Association on the other.

The Conjoint Conference submitted the clause which had previously been agreed by the negotiating committee, while the highway associations made new proposals under which the public utility would be responsible for the removal of sub-surface works if such works had been in the ground for a greater period than 30 years, or in the case of overhead lines, if such lines had been erected for more than 15 years. The London authorities contended that as the highway law relating to London differed in many respects from that applicable to the provinces, no alteration should be made in the present position.

The railway companies were concerned principally with the question of railway bridges and level crossings, and argued that where the presence of public utility works would render any subsequent alteration of the railway system more costly, the extra expense involved should fall upon the public utility.

Public Utilities' Claims Upheld

The Report of the Joint Committee can be regarded, almost without qualification, as a victory for the public utilities. The Committee states that it soon transpired in the course of the hearing that the real point at issue was as to the party which should pay the cost of removing mains and cables where such removal was rendered necessary by highway reconstruction, and with regard to this question they conceived their province was not to determine what has been the law in the past, but to suggest what it should be in the future. For the consideration of this question the Report is divided into two parts, one dealing with highways, and the other with bridges.

With regard to highways, the Report refers to the obligation of public utilities to carry the necessities of life to the public and to their contention that it is one of the functions of the highways to afford facilities for sub-surface works—a function no less important than that of providing for surface traffic.

The Report lays down the principle that the costs of removing mains and cables "should be borne by the party which initiated the proposal to effect the alteration of the highway which necessitated the removal or alteration of the apparatus and so entailed the cost." This, it is pointed out, will almost invariably be the highway authority.

The general principle is, however, subject to the following qualifications:—

(1) Any dispute as to whether alteration is reasonably necessary is to be settled by arbitration.

(2) If the highway authority notifies the public utility that within two years it proposes to alter the highway, and notwithstanding such notification the public utility lays mains or cables in the highway, then the cost of removal is to be borne by the public utility.

(3) If the public utility takes advantage of highway reconstruction to substitute improved apparatus, and lays apparatus at a greater depth than previously, the additional cost so attributable is to be borne by the public utility.

(4) If new apparatus is substituted for old then an allowance for the improvement is to be made to the highway authority.

The Report further recommends that where the Ministry of Transport makes a grant, any costs of removing sub-surface works for which the highway authority would be liable, are to rank for grant. It is also suggested that where a road improvement is in the nature of a town improvement, the expense should be borne by the local authority and not by the highway authority.

With regard to reinstatements, the law as it exists to-day requires a reinstatement of the highway surface to as good a condition as that which existed before breaking open. The Joint Committee therefore arrived at the conclusion that "the liability must differ in each particular case, and nothing in the nature of a standard specification could therefore be devised."

The Joint Committee also states that it sees no objection to the proposal that where a highway authority has a road reconstruction in view, it should be enabled to require public utilities to lay their mains in "prescribed land," *i.e.*, unbuilt-on land immediately adjoining the highway and in regard to which the highway authority has taken formal action indicating its definite intention of incorporating it in the highway and assuming liability for compensation to the owners thereof.

Alterations to Bridges

With regard to bridges, the Joint Committee calls attention to the fact that the Electricity (Supply) Act, 1936, places upon the Central Electricity Board the responsibility for bearing the expense of any removal of apparatus that may be necessitated by the alteration of a bridge.

It is further pointed out that similar provisions are normally incorporated in Electricity Special Orders, and it is therefore suggested that the grounds for requiring public utility undertakers to bear such costs are stronger in the case of a bridge than in the case of highways. Nevertheless, the Joint Committee is of the opinion that the principle applied to highways must also prevail in the case of bridges, and that "the undertakers should not suffer because in the interest of traffic an alteration is made."

Certain recommendations are, however, made with regard to bridges. These are as follows:—

(1) That plans and sections should be sent to the bridge authority as well as the highway authority, when these are different bodies.

(2) That the bridge authority should have power to object to apparatus being laid on the ground that the stability of the bridge would be affected.

(3) That the highway authority should have the right to object to the laying of apparatus on the ground that the thickness of the road material on the bridge is not sufficient. The question could then be referred to arbitration.

With regard to London—which includes the area of 25 electricity undertakers—the Report enumerates the various points with regard to which the Metropolis is in a special position. With one exception the Report does not suggest that this position should be altered. The one exception is the all-important question of the cost of removal of mains. In this connection the Joint Committee sees no reason for differentiating London from the rest of the country.

Works Affecting Railways

The Report points out that by virtue of sub-sections 15 and 19 of the schedule to the Electric Lighting (Clauses) Act, 1899, obligations are placed upon electricity undertakers with regard to railways which are not applicable to gas and water undertakers. It is recommended that such provisions should apply to all public utility undertakers. The Report deals with the various proposals made by the railway companies in the following manner:—

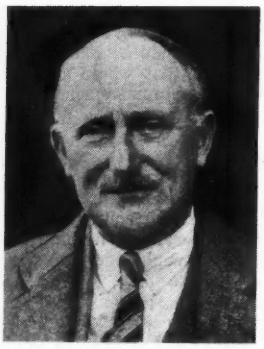
(1) That where works are to be situated in highways crossing a railway whether above or below it, or on the level, the

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

IT is announced that **Mr. B. L. Goodlet,** M.A. (Cantab.), Professor of Electrical Engineering in the University of Cape Town, has been appointed to the Chair of Electrical Engineering in Birmingham University, in succession to the late Professor Cramp. Mr. Goodlet went to South Africa early in 1937. He was previously research engineer with the Metropolitan-Vickers Electrical Co., Ltd. He is an associate member of the I.E.E.

Mr. Peter B. Addison, a member of the engineering staff of the North-Eastern Electric Supply Co., Ltd., retired on June 30th after thirty-eight years' service with the company. Previously he was with the Manchester and Bradford Corporations, and went to Newcastle in 1901 to supervise the laying of the electricity distribution mains in connection with the development of the power supply on Tyneside, which was inaugurated when the late Lord Kelvin officially opened the Neptune Bank power station, Wallsend. For many years Mr. Addison was responsible for the maintenance of the company's high- and low-voltage distributing cable systems on the North-East Coast.

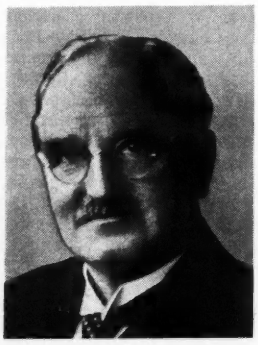


Mr. P. B. Addison

Mr. C. S. A. Wickens, chief operating assistant of the Sheffield Corporation Transport Department, has been appointed general manager of the Luton Corporation Transport Department.

A change of management is announced by Brook Motors, Ltd. Mr. Ernest Brook, founder of the company, has resigned from the position of managing director, but is maintaining an active interest in the firm in his capacity of chairman of directors. Mr. Joseph Louis Brook, who was the general manager, has now become vice-chairman of directors, while Mr. Ernest Brook's two sons, Messrs. Frank V. and John L. Brook, have now become joint managing directors.

Mr. John L. Brook



Mr. Ernest Brook

Mr. Joseph Brook

Mr. Frank V. Brook

Among the guests at the annual dinner of the Ayrshire Electricity Board at Ayr was **Sir Andrew Duncan,** the first chairman of the Central Electricity Board. Proposing the toast of "The Ayrshire Electricity Board," Sir Andrew said that in addition to the present 30,000-kW set two further 30,000-kW sets were to be installed in due course. He was all for cheap industrial rates, and for recognising in a county like Ayrshire the importance of the industrial load. Replying to the toast "Our Officials and Staff," Mr. W. C. Bexon said that in Ayrshire they sold electricity at ¾d. per kWh and many of their consumers were paying less than the Ayrshire Board was paying the C.E.B. He added that the sooner the C.E.B. studied the charges for electricity the better it would be for all consumers.

Mr. F. W. Purse has been elected chairman and **Mr. H. J. Allcock** vice-chairman of the I.E.E. Transmission Section Committee for 1939-40.

Cheltenham Corporation Electricity Committee reports that **Mr. W. J. Bache,** M.I.E.E., the borough electrical engineer, will retire next January.

Mr. P. J. Robinson, city electrical engineer, Liverpool, who has been in the service of the Corporation for thirty-seven years and has reached the age of sixty, proposes to retire. The Electric Power and Lighting Committee has, however, appointed a special sub-committee to confer with him with a view to a prolongation of his services. Mr. Robinson's retirement at the present time is optional. He can, if he desires, remain for a further period of five years when, except by a special resolution of the Council, his term of service would terminate automatically.

Hackney Borough Council Establishment Committee recommends the promotion of **Mr. L. J. Bell** to the position of senior boiler house engineer and the appointment of **Messrs. W. C. G. Smith** and **M. J. Watkins-Bell** as sub-station charge engineers.

Exeter Corporation Electricity Committee reports the retirement of **Mr. H. Manning,** mains superintendent, and recommends the promotion of **Mr. D. R. Beckett,** his chief assistant.

St. Pancras Borough Council Electricity Committee recommends the appointment of **Mr. W. Morley** and **Mr. J. P.**

Mains in Highways (*Continued from preceding page*)

railway company, as well as the highway authority, should receive notice, plans and sections.

(2) That the railway companies should be given the right to superintend the work.

(3) That the railway companies themselves should be given the right of executing and maintaining the works (other than the actual laying and maintaining of the apparatus) at the expense of the undertakers. This should include the right of re-instating. Where the rights of the railway company and the highway authority are in conflict, those of the railway company should prevail in view of the importance of the safety of the railway.

(4) That where apparatus is laid under a level crossing, the railway company should have the right to employ signalmen, &c., to control the traffic on the railway. The reasonable expenses involved should be paid by the public utility, but this should not include responsibility for paying compensation to persons injured.

(5) That the public utility should not be under any liability to pay any additional expenses which the company may incur in altering the railway by reason of the existence of apparatus laid over, under or across the railway.

No recommendation is made with regard to any alteration of the land affecting tramways.

The Joint Committee is in agreement with the suggestion that a Bill should at once be introduced into Parliament to make such modifications of the Gasworks Clauses Act, 1847, the Waterworks Clauses Act, 1847, the Electricity (Supply) Acts, 1882 to 1936, and the schedules to the Electric Lighting (Clauses) Act, 1899, as are necessary to give immediate effect to the proposals contained in the Report.

It is obvious that the Report must be the subject of further consideration by the public utilities and that negotiations with the highway associations on the basis of the Report will probably be resumed. Whatever agreement is eventually achieved, whether it is confirmed by legislation or not, it is obvious that one code, and one code only, should be applicable to all sub-surface works, whether laid before or after the date of the Report. The law as it exists to-day is extremely obscure, and the Joint Committee is to be congratulated on the production of a Report, so admirably clear and concise, which will go far to end the friction which has in the past so frequently arisen between highway authorities and public utilities on this difficult and complicated problem.

Tanner, at present mains assistants to Walthamstow and Finchley Corporations respectively, as mains assistants.

Derby Electricity Committee on June 28th decided to appoint **Mr. J. A. Sumner,** as deputy borough electrical engineer. Mr Sumner is at present chief distribution engineer with the West Midlands Joint Electricity Authority. He served his apprenticeship in mechanical engineering at Beck Works, Nottingham, and after serving in the Royal Air Force during the war he studied at the University College, Nottingham, from 1919 to 1922, when he joined the Derbyshire and Nottinghamshire Electric Power Co. He was appointed chief assistant engineer with the Mid-Cheshire Electric Supply Co., Northwich, and joined the West Midlands J.E.A. in 1930. In 1935 he read a paper before the I.E.E., on "Private Plants and Public Supply Tariffs," and in 1937 he presented a paper before the Institution on domestic load and tariffs.

[Elliott & Fry.
Mr. J. A. Sumner

Sir Montague Hughman presented the prizes at the conclusion of Henley's (Gravesend) Sports Club's annual sports and children's gala on the Club's ground at Craggs Farm, Singlewell, on July 1st. Among those present to see the excellent programme were Mr. and Mrs. W. F. Bishop, and Miss Joan Bishop, Sir Edward Crowe, Mr. A. H. M. Jacob and Miss Jacob, Mr. and Mrs. E. E. Judge, Mr. and Mrs. A. W. McArthur, Mr. and Mrs. W. C. Barry, and Mr. and Mrs. J. S. A. Bunting.

The President of the French Republic attended the opening of the Paris High-Tension Conference on June 29th, and before the meeting a selected number of delegates from all countries were formally introduced to him. The British delegates accorded this honour were Mr. Le Maistre (B.S.I.), and Mr. E. B. Wedmore (E.R.A.), and Dr. P. Dunsheath (W. T. Henley's Telegraph Works Co., Ltd.).

Ilford Corporation Electricity Committee has appointed **Mr. P. E. Smith,** sub-station superintendent, as deputy borough electrical engineer at a salary of £700 a year.

Mr. R. W. Gregory, M.I.E.E., consulting engineer, of Pilgrim House, Newcastle-on-Tyne, announces that from July 1st he is taking into partnership **Mr. H. E. Baker,** B.A. Eng. (Oxford), A.M.I.E.E. The consulting engineers' business will continue at the above address under the existing firm name of R. W. Gregory & Partner.

OBITUARY

Dr. A. E. Kennelly, the distinguished electrical scientist and engineer, died in Boston, Mass., on June 18th, at the age of 77. A note on his career will appear in our next issue.

Mr. A. F. T. Atchison, B.Sc., M.I.E.E., whose death occurred recently in Genoa, was at one time secretary of the British Association. His electrical studies qualified him for a teaching post at the Engineering College at Cooper's Hill, and later he went to Egypt, where he was engaged in connection with the supply of electricity beyond Cairo. He retired when Egypt became independent.

Lord Mount Temple.—The death occurred on July 3rd at Romsey, Hampshire, at the age of 71, of Lord Mount Temple. As Lt.-Col. Wilfrid Ashley he was Minister of Transport from 1924 to 1929, and it was during his term of office that the 1926 Electricity (Supply) Act was passed.

Will.—Mr. R. S. Middleton, deputy-chairman of Richardsons Westgarth & Co., left £123,812, with net personalty of £111,568.

I.E.E. Conversazione

AS a meeting place for the electrical world and his wife, the annual Conversazione held by the Institution of Electrical Engineers loses none of its pull. Each year not only London members, who can quite conveniently make the journey to South Kensington, but also those from the most remote of the local Centres with their ladies turn up in force. One noticed, moreover, that some of the delegates to the High-Tension Conference, now in session, had managed to tear themselves away from their Labours in Paris to recuperate at the social gathering in London.

This year was no exception to the general rule, and on Tuesday this week the President (Dr. A. P. M. Fleming) and Mrs. Morris Fleming shook hands with over 2,500 people. Seconding their efforts, we were glad to see Mr. P. F. Rowell, the retiring general secretary, who has not enjoyed the best of health recently, and Mrs. Rowell.

While the usual colloquial reference to the Conversazione as a rendezvous is "among the elephants," this does less than justice to the rest of the very fine collection of specimens (several of species long since extinct) in the portion of the Natural History Museum that is thrown open to those taking part in the function. To many whose knowledge of natural history is limited (those who, for instance, find it difficult to decide whether the appropriately named whale shark is a fish or a mammal), the superbly mounted animals have, year after year, an obvious attraction. Indeed, the information imparted in the programme about what there was to see in this way clearly vied in interest with the directions as to how to find the way to the various places in the building at which refreshments might be obtained.

It would be difficult to find an electrical gathering at which so little was heard about electricity. A most enjoyable evening nevertheless.

1. Miss Highfield, Mr. J. S. Highfield and Dr. Alexander Russell

2. Mr. and Mrs. P. F. Rowell greeting Miss M. Manson and Mr. R. M. Moberly

3. Mr. F. W. Crawter, Mrs. E. K. Muir, Lieut.-Col. W. A. Vignoles and Mr. E. K. Muir

4. A section of the gathering

COMMERCIAL AND INDUSTRIAL NEWS

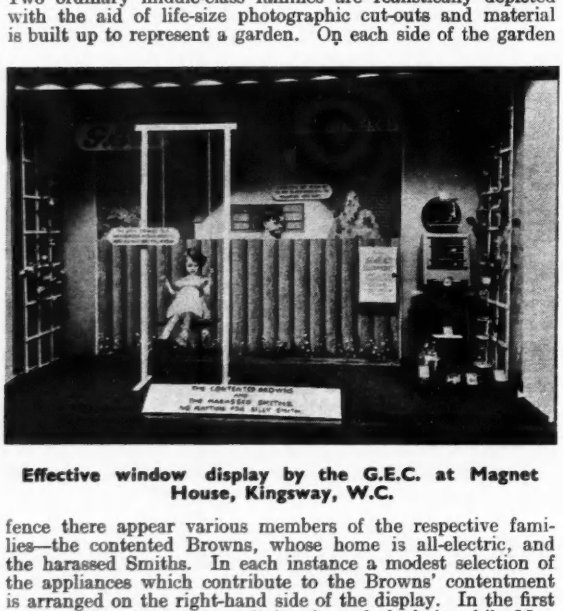
Cable Industry Inquiry. A Billet Heating Furnace. Electric Drive in a Pottery. Meter Examination Fees. Irish Lamp Smuggling

Scottish Wage Increase

THE Scottish Joint Industrial Council for the Electricity Supply Industry has agreed to the proposal of the unions for higher wages for various classes of workmen. The agreement will give an increase of ¾d. an hour to blacksmiths, electricians, fitters, machinemen, meter repairers, and turners, and an increase of ½d. an hour to cable jointers. It is also decided that men employed on shift work receiving rates equivalent to daily labourers should have rates advanced by ½d. an hour. The agreement is subject to confirmation by the National J.I.C. in London. It is expected that the increases, if approved, will take effect in August.

Dramatic Propaganda

An interesting series of window displays has been arranged at the head office of the General Electric Co., Ltd., in London. Two ordinary middle-class families are realistically depicted with the aid of life-size photographic cut-outs and material is built up to represent a garden. On each side of the garden



Effective window display by the G.E.C. at Magnet House, Kingsway, W.C.

fence there appear various members of the respective families—the contented Browns, whose home is all-electric, and the harassed Smiths. In each instance a modest selection of the appliances which contribute to the Browns' contentment is arranged on the right-hand side of the display. In the first display, Mrs. Brown is reclining in a deck-chair while Mrs. Smith, tired and untidy, snatches a moment from her housework to look on enviously. Another display shows the Browns' little daughter on a swing while young Billy Smith bemoans his fate—he cannot come out to play because his mother is busy and he has to help her with the housework. Then Mr. Brown is seen explaining to his neighbour that electricity saves money and makes life easier. The windows were devised and designed by the G.E.C. display department.

Wages in the Contracting Industry

In dealing last week with the new zoning arrangement negotiated between the National Federated Electrical Association and the Electrical Trades Union we gave the current rates but, unfortunately, omitted some explanatory notes. The rate for Grade A. (1s. 9¾d. per hour) is subject to a 5 per cent. addition, bringing it up to 1s. 10¾d. As regards Grade B, the ordinary rate of 1s. 7¾d. is raised to 1s. 8¾d. in the Mersey area within a radius of ten miles of the Liverpool landing stage, and also including the towns of Runcorn, Widnes and St. Helens. The rate for Belfast (Grade C) is subject to an addition of 3 per cent.

Juvenile Labour in Cable Making

The Home Secretary has appointed Sir Harold S. Morris, K.C., to hold an inquiry regarding the hours of employment of juveniles under sixteen in the cable-making industry. Under the Factories Act, 1937, the hours of employment of boys and girls under sixteen in factories are to be reduced from forty-eight to forty-four a week after the end of June. The Home Secretary may increase the number of hours up to forty-eight for particular classes of factory or processes if he is satisfied, as a result of a public inquiry, that the conditions specified in Section 71(2) of the Act are fulfilled. The inquiry will consider whether, in the case of factories in which is carried on the manufacture of insulated electric cables, the conditions are fulfilled either generally as respects the industry carried on in such factories or as respects any particular processes and, if so, will advise the Minister on the scope and terms of any regulations which might be made under the subsection for such industry or processes. The Cable Makers' Association has applied for a forty-seven-hour week for such young persons. Any organisation or person who may desire to make representations at the inquiry should give notice to the secretary, 1, Abbey Garden, Great College Street, London, S.W.1, that they desire to be heard, or submit their representations in writing to the secretary. The date for opening the inquiry is not yet fixed.

Minimising Incendiary Risks

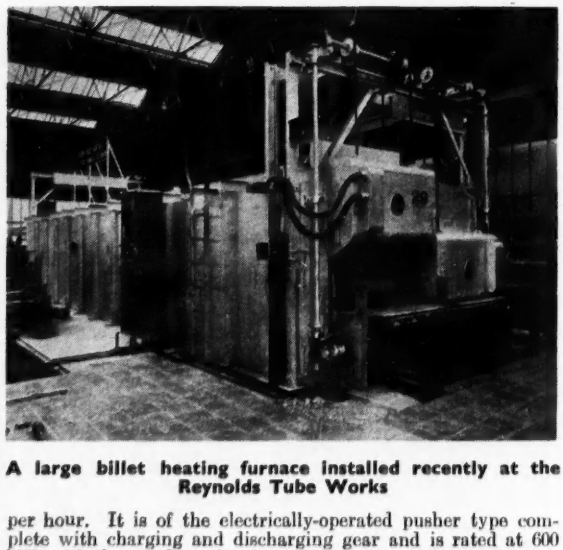
Civil defence activities cause consideration to be given to incendiary risks. How useful in this respect many of the products of Bell's Asbestos & Engineering, Ltd. of Slough, can be was made evident by a display in London last week. For example, the "Bestobell" lightweight suit, combined with helmet, boots and gloves, all made of fire and heat-resisting asbestos, protects every part of the body and allows freedom to a man passing quickly through or remaining close to a serious fire for vital rescue work. Somewhat similar is heavier equipment which enables men of good physique to remain in actual flame contact for brief periods. Among standard "properties" that can be kept in a department where fire is possible are mobile screens of heavy asbestos cloth on a steel frame fitted with wheels. Their purpose is to isolate fires, give cover for the fire-fighters, also asbestos cloth, loose covers can be made to protect desks, office files, and furniture, thus giving them protection from splashes from incendiary bombs or from adjoining outbreaks. Asbestos cloth curtains are made in a variety of designs. One type intended for use specifically in archways, passages and corridors is a gravity operated drop-curtain, weighted at the bottom with sand and worked by local, remote, manual or automatic control, or brought into place merely by the heat melting the fusible catch which keeps them rolled. Other products include asbestos blankets, gloves and face protectors. A handy first-aid outfit, which consists of a hand-pump extinguisher, asbestos smothering blanket, and means for the treatment of burns, is obtainable in a stand with various colour finishes.

Anglo-Swedish Trade Talks

The Swedish trade delegation, whose visit is sponsored by the F.B.I., arrived in London on Monday last for conversations directed to the strengthening of British exports to Sweden. Products being discussed at the meetings between the visitors and their opposite numbers in Britain include rolling mills, electric furnaces, and insulators. The entertainment programme includes a dinner at the Grocers' Hall, given to the delegation by Mr. P. Bennett, president of the F.B.I. Mr. Oliver Stanley was to preside at the dinner to be given by the Government at the Savoy Hotel yesterday (Thursday), and to-day (Friday) the Swedish Chamber of Commerce will be hosts to the delegates at a dinner with Baron O. Thott, vice-president of the Chamber, in the chair.

A Large Billet Heating Furnace

A few weeks ago an electric billet heating furnace, believed to be the largest of its type in the world, was put into commission at the works of the Reynolds Tube Co., Ltd., at Birmingham. The furnace, which is the fourth installed at these works by G. W. B. Electric Furnaces, Ltd., during the last three years, is used in conjunction with a 5,000-ton extrusion press, and the complete installation is capable of handling billets up to 20 in. diameter by 4 ft. long, at the rate of four



A large billet heating furnace installed recently at the Reynolds Tube Works

per hour. It is of the electrically-operated pusher type complete with charging and discharging gear and is rated at 600 kW, with three independently controlled zones. The chamber is 39 ft. long by 9 ft. wide by 1 ft. 10 in. clear height above the

hearth, and the maximum output is four billets 20 in. diameter by 4 ft. long, each weighing approximately 1,650 lbs. per hour, its capacity being forty billets of the above dimensions. The design of the plant incorporates the Gibbons-Marchant pusher mechanism which is already being used in continuous furnaces for the annealing of brass and copper components supported in trays, and, in addition to the conveying gear, a simple method of loading the charging table with billets from the floor level is introduced by using the same electric drive during the idle or return stroke of the pusher arms. Each door, the hearth plate and tilting gear are interlocked and operated by an electric drive. To ensure absolute uniformity the furnace is divided into three separately controlled zones and provided with centrifugal fans mounted on the roof structure. The resistor elements, which are of strip design, are fitted in the roof and hearth only, a Gibbons-Wild-Barfield patent method of support ensuring that the maximum radiation factor and free circulation of air around the elements be attained.

Factory Lighting

Mr. H. Lingard, manager of the E.L.M.A. Lighting Service Bureau, addressed approximately fifty of H.M. Inspectors of Factories when they visited the Bureau last week. He stressed the importance of light measurement in all factories, since, he said, scientifically measured light was the only guarantee of maintained lighting levels. Reduced lighting levels, through nothing more or less than sheer neglect, reduced working efficiency, and in most cases it was not until the change was really noticeable that steps were taken to remedy the state of affairs. A constant standard of lighting which demanded regular maintenance, planned lamp renewal, and also maintenance of walls and ceilings, could only be assured if up-to-date methods of light measurement were used.

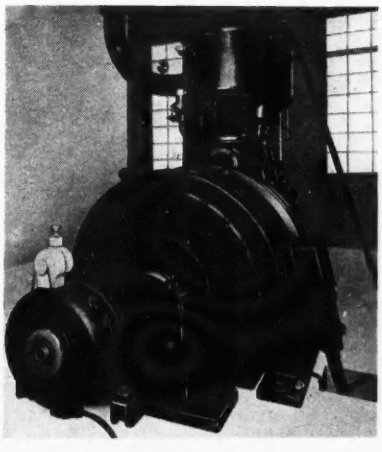
Speaking after Mr. Lingard, Sir Duncan Wilson, H.M Chief Inspector of Factories, complimented the Bureau not only on the excellence of its demonstration facilities, but on the genuine good it was doing for the nation as a whole in its perpetual fight for improved lighting conditions. Sir Duncan said he was in full agreement with the recommendation that a special lighting conference should be held in London in the near future for industrial interests, but suggested that it would be advisable to plan similar conferences in the provinces for factory executives who could not spare the time to visit London.

Durban to Buy British Cable

The Durban City Council is recommended to accept a British tender of £2,065 for telephone cable although a German tender of £1,757 was received, states *Reuter*. Altogether there were 14 German tenders.

Modernising a Pottery Plant

At the pottery of W. Adams & Sons (Potters), Ltd., Stoke-on-Trent, a beam engine well over a hundred years old has just been replaced by electric drives, power being supplied from a 250-kW, 0.8 power factor, three-phase, 50-cycle, 415-V Crompton Parkinson alternator, direct coupled to a Belliss & Morcom steam engine, which also provides steam for process work. The steam engine was installed complete with all necessary steam and exhaust pipes, by the Norris Warming Co., Ltd., London, W.C.1. The main switchboard consists of two 300-A Crompton "Klad" switch-pillars, one being for the control of the alternator supply and the other a feeder for power and lighting. The alternator control panel is a "Klad A" unit, with isolating features, the usual alternator equipment being provided, including DC field equipment and field regulator control all on one panel. The outgoing feeder is a "Klad B" unit, without isolating features, an ammeter being provided for indication of the outgoing load. The board is being extended with a further 300-A unit to cater for additional power load in the workshops. The alternator is provided with a Brown-Boveri automatic voltage regulator.



The 250-kW Crompton Parkinson alternator direct coupled to a Belliss and Morcom steam engine, installed at the works of Wm. Adam and Sons, (Potters), Limited

The potters' machinery installed consists of 12 ft. diameter stone and flint pans, also 6 ft. 6 in. glaze pans and colour pans and various auxiliary equipment. Each of the larger diameter pans is driven by a Crompton Parkinson 40-HP slip-ring protected type motor with slip-ring short-circuiting gear, and coupled direct to a David Brown reduction gear to give a final speed of 14 RPM. The smaller diameter pans, two of which are driven off one motor, are powered by 30-HP, 1,460-RPM, C.P. protected type slip-ring motors also with reduction gear. In addition a 40-HP slip-ring motor and starter has been supplied for a crusher, and additional motors of varying sizes from ¼ to 25 HP are being installed from time to time in connection with the completion of the electrification. The electrical installation has been carried out by Tomlins, Ltd.

Hughenden Manor

Hughenden Manor, near High Wycombe, the home of Benjamin Disraeli, Earl of Beaconsfield, from 1847 until his death in 1881, was recently opened by the Earl of Derby as a museum of Disraelian heirlooms. It has been completely rewired with Henley cables by T. & E. Hammond, who in-

Hughenden Manor, just opened as a museum of Disraelian heirlooms

stalled 230 lighting and 12 power points. The museum section called for very careful work, the original wallpapers and decorations being retained. Nevertheless, it is difficult to see any traces of electrical work. For the convenience of the curator, the lighting switches for each floor of the museum have been grouped at one central switchboard. The library is interesting for its 12-light solid brass chandelier. This, together with all the other fittings, was removed and rewired; the original system for these fittings was a single wire with an earth return, the electricity supply having come from a 110-V private plant. Picture lighting has been fitted to the more important of the paintings. Two 2-HP, 400-V single-phase electric pumps provide the water supply for the building.

Perfect Business

The following story appears in the August issue of *World Digest*, the new sixpenny monthly issued by Amalgamated Press, Ltd., dealing with current fact and comment:—

Teacher: "Who is the world's greatest inventor?"

Willie Wise: "Edison. He thought out the phonograph and the radio so people would sit up all night and use his electric light bulbs."

Trade Announcements

On and after July 30th the business of Cosway (Sales), Ltd., will be transferred to Queen's Cross, Dudley (telephone: Dudley 2599 and 2590). The new premises will be considerably larger, and facilities for manufacture will be greatly improved.

Since their works at Heather Park Drive, Wembley, are required for a manufacturing process, J. Gerber & Co., Ltd., together with the associate company, Kessel (Power Plants), Ltd., have transferred their machinery trading business and their workshops to the Palace of Engineering, Wembley Exhibition Grounds, where a new factory has been constructed to the company's own design. The telephone number is unchanged.

Basol, Ltd., have moved to Malt House, Moor Lane, Staines (telephone: Staines 128).

Kettering School Installation

Features of Kettering's new Henry Gotch Schools, opened on Friday last, which have been erected at a cost of £48,000, include an electrically controlled heating system. Electric buzzers have supplanted the traditional school bell, and radio relay service points are installed for school broadcasts. Kettering Electricity Department was responsible for the electrical installation.

Ventilation

Vent-Axia, Ltd., 9, Victoria Street, London, S.W.1, has sent us a leaflet giving views of some recent fan installations, including a service kitchen, factory, canteen, ballroom and classroom, together with some users' opinions of these installations. The company informs us that it has a special department fully qualified to undertake the cutting of glass

for fixing Vent-Axia units, and also distributors in various parts of the country who can arrange for the cutting of glass outside the London area.

Examination of Meters

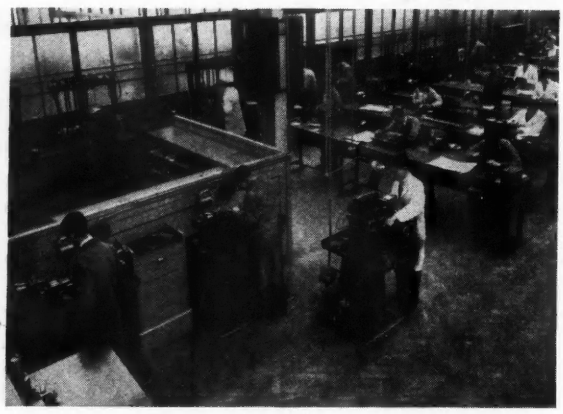
The Electricity Commissioners announce that in pursuance of Section 1 of the Electricity Supply (Meters) Act, 1936, they have prescribed that, until further notice, the fee in respect of meters examined and/or certified on and after July 1st, shall be 2½d. instead of 3d. This fee will not apply to cases involving the examination and certification of particular meters at the request of consumers or the undertakers.

Irish Lamp Smugglers

At Cavan last week three men were each fined £1,365 upon conviction for smuggling lamps over the Northern Ireland border into Eire, their ultimate destination being Dublin. The prosecution said that electric lamps were subject to a quota, and there was apparently a "whole chain of conspirators" engaged in the business.

Smith's Technical School

Smith's English Clocks, Ltd., have for a number of years taken a considerable interest in the training of their younger employees, and early last year, to remedy the lack of an adequate supply of "precision-minded" engineers, the directors decided to start a works technical school for the training of selected pupils. Two fully qualified Swiss gentlemen were



Students receiving practical training at Smith's Technical School

engaged as instructors, and with the co-operation of the works manager and his staff, a school was equipped and a selection of students made. The school has been in operation for four months, and the experiment can be looked upon at this stage as being most successful.

World Trade and Peace

In the course of his address at the recent Conference in Copenhagen of the International Chamber of Commerce, the president, Mr. T. J. Watson, said that the Chamber believed that world peace would come through world trade. The Trade Expansion Committee set up under the chairmanship of Dr. Fentener van Vlissingen to work out a practical programme of trade development had worked for two years studying all possible methods of approach. It had, however, been forced to recognise that it was up against an obstacle which, if not surmounted, spelt economic disaster; that obstacle was the armaments race which made it impossible to plan or work for better living conditions by developing trade and co-operating on a peaceful and progressive basis. He called upon the Governments to stop planning destruction and make the necessary economic adjustments by peaceful means. Addresses expressing similar sentiments were delivered by Dr. Fentener van Vlissingen and Sir Alan G. Anderson, honorary presidents of the I.C.C.

New Ferranti Radio Sets

The new season's radio and television receivers to be released by Ferranti, Ltd., in August and September, have been on view to the trade at Bush House, London, from Tuesday to Friday of this week. One of the five broadcast receivers has a moulded cabinet, the others being in walnut; all are superhets. The four-valve battery set with 200 mW output and fixed tone correction employs 1.4-V valves, and a single dry battery is used to energise both anodes and filaments.

The other sets are of the five-valve (including rectifier) AC class with 4-W pentode output and moving coil speaker, extension speaker sockets, gramophone pick-up connections, and three ranges of 16.5/51, 200/560 and 1,000/2,000 metres. The first model has a three-colour edge-lighted dial, the second a rotating pointer and the third mechanical push-buttons for selecting six stations, with illuminated three-colour dial. The fourth set has a ganged permeability push-button system (cathode-ray tuning) and wave-changing is also by push-button. An additional button acts as a mains "off" switch, but pressure on any one station button switches the set on and, at the same time, selects the required station. The edge-lighted dial has three coloured neon wave band indicators.

The three television sets are a table model with a 7.5 by 6 in. screen and two consoles with 10 in. by 8 in. screens. One of the consoles incorporates an all-wave broadcast radio reproducer as well as the television and accompanying sound receivers. The chassis is the same in each case and enables all components to be mounted in the same plane. This makes service maintenance easier by affording greater accessibility. The cathode-ray tube employs all-magnetic permanent magnet focusing and magnetic scanning. A protective armour glass window is fitted over the tube screen. There are three vision controls.

Japanese Lamp Exports

Export figures of electric lamps from Japan for the first quarter of 1939 indicate that they have been fairly steady, and that from all appearances the end of this year will see a further increase in volume. A survey of the market also reveals that while the cost of raw materials, wages and freight has advanced in the meantime, the effect on export prices of electric lamps has not been at quite the same ratio. Although exports to England have remained stationary, the demand from the United States has shown a steady increase. The effect on the volume of exports may be seen from the following tables for the first quarter of 1939, compared with those for the same quarter last year :—

Jan.-Mar.	Household lamps over 20 V.	Large size and fancy size lamps over 20 V.	All types of lamps below 20 V.
1939	4,879,372	2,856,435	12,564,334
1938	5,183,756	687,264	15,376,543

French Luminous Discharge Tube Regulations

Two committees of the French Union des Syndicats de l'Electricité have lately drawn up a new series of regulations to control the installation of luminous discharge tubes operating at what are termed "second category tensions."

Problems of Artificial Illumination

The invisible radiation (ultra-violet and infra-red rays) from electric lamps is discussed in part IV of the series of booklets issued under the general title of "Problems of Artificial Illumination" by the research laboratories of the General Electric Co., Ltd., Wembley. The various regions of the spectrum are considered first; then materials which absorb radiation of this kind and, finally, the energy outputs of several types of "Osira" discharge lamps within relevant portions of the spectrum.

Orders Recently Booked

G.V.D. Illuminators, Ltd., has secured contracts for lighting a control room and a public library for the Wellington City Corporation, New Zealand, and for the interior lighting of a number of new trolley-buses for Trinidad.

Railway Directory

A great deal of interesting information relating to railway electrification is included in the "Universal Directory of Railway Officials and Railway Year Book," the 1939-40 edition of which has just been published by the Directory Publishing Co., Ltd., 33, Tothill Street, Westminster, S.W.1. (Price 20s.). Further development in the conversion of main line steam railways has again necessitated considerable alteration of the tabulated information on this subject, and the table of the world's total railway mileage has been completely revised and amended from official replies to a questionnaire. The directory contains 608 pages and there are three indexes, namely, an index to countries, a general index, including all references to railways and statistical and other information, and a personal directory of railway officials. The lists of railway officials have been brought up to date.

New E.C.A. Members

At a recent meeting of the Council of the Electrical Contractors' Association a number of applications for membership were considered, and the following contractors were admitted to full membership :—Wm. Collins & Co., Belfast; Smith Bros. (Construction), Ltd., Birmingham; Tucker Electrical Co., Ltd., Cardiff; Refrigeration Specialists, Ltd., Derby; L. O. Dickinson, Kesgrave, nr. Ipswich; J. Thorn & Sons, Exeter; J. W. Gladwin & Sons, Ltd., Grimsby; Tom Jones (Electrical Engineers), Ltd., Liverpool; W. T. Lawrence & Son, London, W.C.1; Jones, Morris & Co., Ltd., Chorlton-cum-Hardy; A. Anderson & Son (Electrical Engineers), Ltd., Middlesbrough; W. E. Greenfield, Peterborough; A. C. Sharpe, Peterborough; T. Hadfield, Heywood, Lancs; Harry Smith, St. Albans; E. G. Kellond, Ltd., London, N.W.3; A. O. Gibbons, Ltd., Soho, W.1; Phillips & Sons (Electrical), Ltd., London, S.W.6; C. H. Marsh & Co., Harrow Weald; Universal Installations Co., London, E.C.3; and L. A. Hare, Manchester. The following contractors were admitted to associate membership :—F. Maudsley, Barrow-in-Furness; Everard & Daysh, Tonbridge; and Pearce and Hodges. Port Talbot.

Storage of Protective Clothing

It is preferable for protective clothing used by A.R.P. workers to be stored at a temperature not exceeding 75 deg. F. and not less than 40 deg. F.; for example, in a room fitted with electric "unit" heaters through which air is blown by an electric fan. To maintain the temperature within the required limits at all seasons of the year, the British Thermostat Co., Ltd., offers a double contact thermostat which makes and breaks two circuits simultaneously. One of these circuits controls the contactor operating the main switch in the

heating circuit and the other the contactor operating the main switch in the fan motor circuit. This thermostat switches both heaters and fans on and off as required, but to cope with summer conditions when the storage temperature is likely to exceed the safe limit a second single-circuit thermostat is wired in parallel with the fan contact of the double circuit thermostat and is arranged to switch on the fans only when the temperature within the store exceeds 70 deg. F., thus circulating air throughout the storage space. The double contact thermostat is the "Teddington" Model K7 vapour pressure type with two mercury tube switches. The single contact Model K5 is identical but has only one mercury tube switch. Alternatively, Models YM2 and YM1 could be employed on a similar principle but having open-type silver contacts with magnetic snap action. If desired, excess temperature protection for the heating elements in the event of fan failure can be provided by the Type ET cut-out which consists of a 10-A open type switch held in the "on" position by a ratchet device against the pressure of a spring which is released on the melting of a fusible element. The cut-out is attached to the heater frame and operates when the frame temperature exceeds 205 deg. F. These instruments give a visual indication of their operation, and can be reset by pressing a button as soon as conditions have returned to normal.

Electro-medical Treatment

Under the title of "The Truth About Electrical Treatments," the Electro-Medical Trade Association, Ltd., 2, Savoy Hill, W.C.2, has published an interesting and informative booklet which briefly outlines the chief ways in which electricity is used for combating pain and disease. Such matters as galvanic, short-wave radiant heat and ultra-violet ray treatments are all explained in simple language which the lay reader can readily grasp.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price July 5th	Fortnight's inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£37	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax... ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate... ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 8s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium, Bichromate, casks ... per lb.	4¼d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£94	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/2½ to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£197	—
Grade II ... ... ,,	£137	—
Grade III ... ... ,,	£73	—
c Brass (rolled metal 2" to 12" basis)... per lb.	8½d.	½d. inc.
c ,, Tubes (solid drawn) ... ... ,,	11½d. to 11¾d.	—
c ,, Wire, basis ... ... ,,	8½d.	½d. inc.
c Copper Tubes (solid drawn) ... ,,	1/0½d.	—
g ,, Bars (best selected) ... per ton	£78	—
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£48 15s.	15s. inc.
d ,, ,, Wire Rods ... ,,	£53 5s.	15s. inc.
d ,, ,, H.C. Wire ... per lb.	7¼d.	½d. inc.
f Ebonite Rod ½" dia. & up ... ,,	1/10 to 2/3	—
f ,, Sheet ⅛" thick & up. ... ,,	1/4 to 1/8	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	Nom.	—
h India-rubber, Para-fine ... ... ,,	7¾d.	¼d inc.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 15s.	—
i ,, Wire galv. No. 1 P.O. Qual. ... ,,	£23	—
g Lead, English Pig ... ... ,,	£16 10s.	5s. dec.
g Mercury ... ... per bot.	£16 10s.	—
e Mica (in original cases) small ... per lb.	1/– to 2/6	—
e ,, ,, ,, medium ... ,,	7/6 to 15/–	—
e ,, ,, ,, large ... ,,	17/6 to 22/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	—
p ,, ,, drawn bars & rods ,,	1/1d.	—
p ,, ,, rolled strip & sheet ,,	11½d.	—
p ,, ,, wire ... ... ,,	1/1½d.	—
o Platinum ... ... per oz.	£7 10s.	—
d Silicium Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£14 10s.	8s. 9d. inc.
g Tin, Block (English) ... ... ,,	£229 15s.	15s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in this section under the same heading.

It should be noted that prices quoted for copper do not include any allowance for insurance against war risks.

"Ritemp" Cooker Carnival Tableau

The English Electric Co., Ltd., has recently produced a tableau for use at local carnivals. The display is very attractively finished in full colour, and the slogan, "The Secret

The English Electric Co.'s cooker carnival tableau

of Perfect Cooking," emphasises the ease of cooking with "Ritemp" automatic oven control. At the recent Stafford Pageant and Carnival the tableau was awarded second prize in the trades section.

Annual Holidays

Bruce Peebles & Co., Ltd., are closing their works from July 21st to 31st.

New Catalogues and Lists

Runbaken Electrical Products, 13/15, Liverpool Road, Deansgate, Manchester, 3.—Details of a new "Midget" insulation tester.

Hopkinsons, Ltd., Huddersfield.—A leaflet describing a parallel-slide valve.

British Insulated Cables, Ltd., Prescot.—Leaflets dealing with paper pinions and terminal boxes. Publication P.E.340 relating to B.I. rising main junction boxes (White City type), for circuits up to 250 V.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—A booklet on air washers.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.—A catalogue of overhead service accessories.

The Arora Co., Loughborough.—A leaflet illustrating and describing the "Arora" infra-red ray projector.

Revo Electric Co., Ltd., Tipton, Staffs.—A pamphlet containing illustrated particulars of the "Comet" electric iron.

The Revvo Castor Co., Ltd., Archdale Works, Blechynden Street, London, W.11.—List No. 10 giving particulars and prices of the range of "Revvo" patent ball bearing swivel and fixed castors.

Croydon Engineering Co., Ltd., Commerce Way, Purley Way, Croydon.—A pamphlet describing the "Paragon" earth cone for lighting, power, tramway and telephone systems.

Birmingham Electric Furnaces, Ltd., Birlec Works, Tyburn Road, Erdington, Birmingham.—A data sheet showing the operating cost of a 5-ton "Birlec Lectromelt" furnace operating continuously for producing three to four tons of copper shapes per hour.

The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2.—Revised leaflet Z8703 descriptive of new totally enclosed wax-filled chokes for use with high-pressure mercury-vapour electric-discharge lamps. Also copies of the June issue of the G.E.C. Progress Sheet and of the "Osram Bulletin" and an 84-page catalogue of iron-clad switchgear.

Albert Taylor (Manchester), Ltd., Quay Street, Manchester, 3.—Price list No. IM/539 of electrical insulating materials.

Cambridge Instrument Co., Ltd., Grosvenor Place, London, S.W.1.—An illustrated folder giving particulars of Cambridge automatic regulators.

Crossley Brothers, Ltd., Openshaw, Manchester, 11.—The May issue of "Crossley Chronicles" contains descriptions of a number of typical Diesel engine installations carried out by the company.

Henry Wiggin & Co., Ltd., Thames House, Millbank, London, S.W.1, the producers of Monel in this country, have recently published a 30-page booklet on this alloy, entitled "Monel—An Account of Its Properties, Principal Uses, Fabrication and Available Forms." Profusely illustrated, this publication contains much valuable information, and copies are obtainable free on application.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

ZIPTO switch fuses.
DIRECTO-LITE bedlight (agent).
TRICORD pendant fitting.

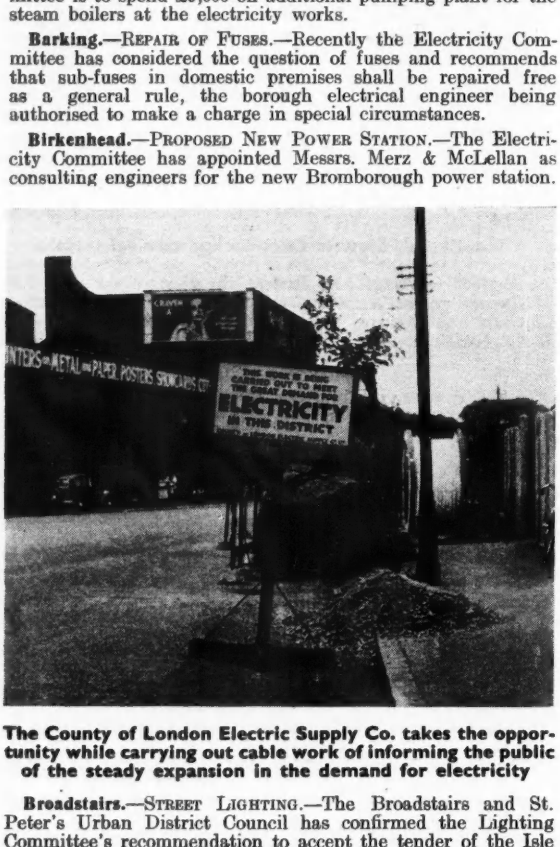
ELECTRICITY SUPPLY

Lower Charges at Cheltenham and Chesterfield. Many Electric Public Lighting Schemes. Suggestion of Small Water Power Plants in Scotland.

Aberdeen.—NEW PUMPING PLANT.—The Electricity Committee is to spend £9,000 on additional pumping plant for the steam boilers at the electricity works.

Barking.—REPAIR OF FUSES.—Recently the Electricity Committee has considered the question of fuses and recommends that sub-fuses in domestic premises shall be repaired free as a general rule, the borough electrical engineer being authorised to make a charge in special circumstances.

Birkenhead.—PROPOSED NEW POWER STATION.—The Electricity Committee has appointed Messrs. Merz & McLellan as consulting engineers for the new Bromborough power station.



The County of London Electric Supply Co. takes the opportunity while carrying out cable work of informing the public of the steady expansion in the demand for electricity

Broadstairs.—STREET LIGHTING.—The Broadstairs and St. Peter's Urban District Council has confirmed the Lighting Committee's recommendation to accept the tender of the Isle of Thanet Electric Supply Co., Ltd., for the whole of the street lighting in the urban district as from April 1st, 1940. This will have the effect of displacing some 527 gas lamps.

Caernarvon.—ELECTRICITY FOR COUNCIL HOUSES.—The Town Council proposes to install electricity in 62 houses on the Cefn Hendre estate.

Cardiff.—STREET LIGHTING CONVERSION.—The Town Council is recommended to convert over 2,000 street lamps from gas to electric lighting.

Cheltenham.—LOWER CHARGES.—In view of the more favourable terms arranged with the Shropshire, Worcestershire and Staffordshire Electric Power Co. for the bulk supply the Corporation Electricity Committee recommends reductions in charges amounting to £3,800 a year.

FRINGE ORDER.—The Committee is seeking a Fringe Order to supply the Rural District Council's pumping station at Birdlip.

Chesterfield.—PRICE REDUCTIONS.—Electricity charges are to be reduced by ¼d. per kWh (flat rate), with proportionate reductions in other rates.

Cleethorpes.—ENGINEER'S REPORT.—In his report for the past year Mr. B. S. Lord, the borough electrical engineer and manager, records that with the 335 new consumers obtained during the year 6,764, or 83.5 per cent., of the premises in the area are now supplied from the department's mains. The field of development is practically restricted to domestic and business premises, yet it has been possible to secure an increase in sales of 29 per cent. (total 6.7 million kWh) and in three years the quantity sold has more than doubled. Last year the number of cookers connected rose by 213 to 784, washboilers by 72 to 248, water heaters by 72 to 193, and radiators by 83 to 218. Electric street lighting was extended more than in any previous year, and the number of lamps in use at the end of March was 529 (159 increase), of which 118 were mercury electric-discharge. The total revenue for the year was £38,659 (against £36,677), but chiefly due to the increased cost of coal working expenses advanced by a larger amount, being £27,180 (against £24,180) and there was a small net loss of £779 as compared with a profit of £1,028 in the previous year.

Durham.—SCHOOL INSTALLATION.—The County Education Committee is to install electricity at the Burnhope junior mixed school.

East Challow (near Wantage).—STREET LIGHTING.—Last week the Parish Council accepted the tender of the Wessex Electricity Co. for street lighting for ten years.

Eastbourne.—15-GAL. WATER HEATERS.—The borough electrical engineer recently reported that there appeared to be a demand for 15-gal. water heaters, and the Electricity Committee agreed to the inclusion of this size in the hire scheme at 7s. 6d. and 8s. 6d. per quarter.

Grimsby.—SUPPLY TO AYLESBY.—The Corporation plans to borrow £2,280 for the proposed supply to be given to Aylesby.

Hailsham (Sussex).—STREET LIGHTING AT WILLINGDON.—Last week the Rural District Council approved a recommendation for the provision of 120 street lamps at Willingdon. Tenders were received from the Eastbourne Electricity Department (annual instalment on capital cost £150; maintenance, £168) and the gas company (annual instalment on capital cost £100; maintenance, £235), the electricity tender being accepted.

Lancaster.—POWER POINTS IN SCULLERIES.—The Town Council has referred back for further consideration a decision by the Health Committee against the installation of power points in the sculleries of houses on the Ryelands housing estate. Councillor L. Oakes said that any improvements which could be introduced into the homes of the people should be provided. Alderman Simpson remarked that power plugs were installed in the kitchens of the houses and he did not think it necessary to provide them in the sculleries.

Liverpool.—LOAN FOR COOKERS.—Application is being made by the Electric Power and Lighting Committee for sanction to borrow £75,000 for the provision of domestic cooking apparatus.

London.—ST. PANCRAS.—The Electricity and Public Lighting Committee has informed E.D.A. that while it is not prepared to make the possession of the Association's salesmanship certificate and diplomas necessary in connection with applications for positions on the sales staff, it is willing to regard them as an additional qualification.

It is proposed to build and equip a sub-station at the new Langham (Museum) automatic telephone exchange at an estimated cost of £3,377.

HAMMERSMITH.—A number of extra-high voltage works are to be put in hand by the Borough Council. At present, the supply to the e.h.v. sub-stations at Beavor Lane, Down Place and Starch Green is given by two cables from the generating station to each sub-station, and in the event of failure of one cable the other might, under certain conditions, be overloaded. It is, therefore, proposed to lay interconnecting cables between the Beavor Lane and Starch Green sub-stations (£1,581) and between the Down Place and Town Hall sub-stations (£1,935). A further expenditure of £5,591 is to be incurred on the replacement of switchgear and extensions at the Down Place substation. Additional cables are also being laid and a new substation built by the Brentford and Chiswick Corporation in connection with the bulk supply obtained from Hammersmith.

Owing to the increase in the demand in the northern part of Hammersmith it is proposed to provide a new e.h.v. main at a cost of £943, and to meet development in the Hamlet Gardens and Westcroft Square district the l.v. distribution system is to be supplemented by two cables at a cost of £333. The provision of a three-phase supply to a new depôt of Rolls-Royce, Ltd., will involve an expenditure of £591.

Lytham St. Annes.—SAFEGUARDING THE SUPPLY.—The Electricity Committee has approved in principle a scheme for an extension of transmission lines for safeguarding the supply to Fylde Coast authorities.

Kettering.—SWITCH-HOUSE.—A new switch-house is to be erected for the Electricity Department in Rockingham Road at an estimated cost of £1,025.

Manchester.—EXTENSIONS.—Permission is being sought by the Electricity Committee to borrow £53,500 for extensions at the Greenwood Street sub-station and £250,000 for distributor and feeder mains.

Northampton.—PUMPING PLANT.—In connection with a proposal to increase the plant at the waterworks at a cost of £5,000 alternative tenders for electric and Diesel pumping sets are to be obtained.

Newark.—LIGHTING IMPROVEMENTS.—The Town Council is approaching the Minister of Transport with a view to obtaining a grant for relighting the principal main roads. A scheme for sodium discharge lighting is estimated to cost £1,920.

Northern Ireland.—BELFAST DISTRIBUTION EXTENSIONS.—The Town Council proposes to borrow £92,361 for the extension of the distribution system.

Portknockie.—INQUIRY.—Mr. A. D. Erskine, Ministry of Transport, held an inquiry at Portknockie, into the Town

Council's refusal to allow the Grampian Electricity Co.'s overhead network of electricity wires to be carried on wooden poles. The Council contended that underground cables should be used, because wooden poles were unsightly and dangerous, as they would narrow the 4 ft. pavements by 11 in. The Grampian Co.'s contention was that underground cables would be too expensive. After evidence had been given Mr. Erskine said he would report to the Ministry.

Scotland.—WATER POWER POTENTIALITIES.—The Association for the Preservation of Rural Scotland has submitted to the Secretary of State for Scotland a memorandum urging that cheap water power should be made available throughout the Highlands. Almost every glen, it is stated, has a burn which could operate a hydro-electric plant of small size, which could be made almost automatic and have low running costs. Short distribution lines would also decrease the cost of the power. The provision of such plant would be a suitable subject for loans at low interest rates. The exploitation of water power should be prevented and the power used primarily as a means to a single end, that of promoting industries suitable for the area and increasing the amenities of life of the local inhabitants.

Selston.—ELECTRIC STREET LIGHTING.—At a meeting of the Parish Council last week, it was reported that by a new agreement with the Derbyshire and Nottinghamshire Electric Power Co., all the streets will be lighted by electricity from September, 1940.

Shildon (Durham).—ELECTRICITY CHOSEN.—After receiving reports of visits to other towns to inspect systems of street lighting by gas and electricity, the Urban District Council has adopted a scheme put forward by the North Eastern Electric Supply Co., Ltd. Mercury-vapour electric-discharge lamps are to be used. The present system of street lighting is by gas.

Stalybridge.—CONTRIBUTION TO RATES.—The Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board is granting £2,750 to each of the four constituent authorities towards the relief of the rates. For several years in the Board's early days the authorities contributed large sums out of the rates to make up the Board's deficiencies. Alderman Fawley, chairman of the Finance Committee, says that this is the largest grant the Board has yet made, but he doubts very much whether it can continue at this figure in future.

Stanley (Co. Durham).—SPECIAL ORDER.—The Urban District Council has announced its intention of applying to the Electricity Commissioners for a Special Order enabling it to extend its area of supply to the Craghead and East Castle districts.

Stoke-on-Trent.—STREET LIGHTING.—The Electricity Committee proposes to install high-power lighting in various thoroughfares at a cost of £5,370.

DISTRIBUTION WORKS.—Voltage regulators are to be installed at a cost of £250 each at the premises of Doulton & Co., Ltd., Burslem, and Grindley & Co., Ltd., Tunstall, where electric kilns are used. The supply is also to be improved at a cost of £650 in connection with a further kiln to be installed by G. Jones & Sons, Ltd., at the Crescent Pottery. Application is being made for a Fringe Order to provide a supply to smallholdings on the Cocknage estate, Longton. Low-voltage distributors are to be provided at Wolstanton at a cost of £900, and the supply at Cobridge is to be improved at an estimated cost of £600.

Sutton Coldfield.—NEW SUB-STATION.—At an estimated cost of £1,325 the Electricity Committee is to provide a sub-station in the Maney Hill district.

Tow Law (Co. Durham).—ELECTRICITY SUPPLY PROPOSAL.—When reference was made to the extensive repairs necessary to the gas undertaking at a recent meeting of the Urban District Council, a suggestion was made that the Council should ask the North-Eastern Electric Supply Co., Ltd., to estimate the cost of supplying electricity throughout the district. The Council is to consider the matter further before making a decision.

West Bromwich.—HIGH-VOLTAGE FEEDERS.—The Electricity Committee is to extend the high-voltage feeder system in the Black Lake district at a cost of £17,514.

Weymouth.—SUPPLY EXTENSION.—The Electricity Committee is to provide a supply to Bincombe at a cost of £2,111.

Windsor.—ELECTRICITY FOR HOUSES.—The Town Council is applying for sanction to borrow £2,280 for the installation of electricity in 288 houses.

Wolverhampton.—BULK SUPPLY SUB-STATION.—A site in Greenfield Lane has been obtained by the Electricity Committee for a sub-station required by the Corporation to take supplies from the West Midlands Joint Electricity Authority in connection with the tapping of the grid at Bushbury.

STREET LIGHTING.—The Electricity Committee is to install lamps on housing estates at a cost of £879.

Overseas

Canada.—POWER PROJECTS.—The Montreal Engineering Co., Ltd., is reported to be arranging contracts for a 7,500 HP development on the Black River, near Wolfville, Nova Scotia, for the Avon River Power Co., Ltd., subsidiary of Nova Scotia Light & Power Co., Ltd. In 1930, the company completed a power development on Black River with an installed capacity of 4,500 HP, to which the present project is to be an extension.

India.—BIHAR ELECTRIFICATION SCHEME.—As a result of the decision of experts, the Government of Bihar has decided to undertake the scheme of electrification prepared by its special officer. It is proposed to build a central generating station

Birmingham's Full Programme

APART from the construction of the Hams Hall "B" generating station, the main stanchions of which are now being put up, the Birmingham Electric Supply Department has in hand the work of changing over the distribution system from DC to AC, increasing the voltage of supply on the e.h.v. transmission system, the standardisation of frequency in accordance with the Central England Scheme, and a large programme of mains extensions.

On Tuesday the Committee presented a report to the City Council showing that during the past year an additional 31,615 consumers were connected, making the total at March 31st last 283,479, and it is remarked that there is every indication that this rate of progress will be maintained. Only last July the City Council sanctioned an expenditure of £200,000 for services and already £126,923 has been spent. To meet the requirements during the ensuing year a further loan of £100,000 will be needed. In addition, the loan of £450,000 for mains extensions approved two years ago will probably be spent by the autumn, and it is estimated that a further £400,000 will be required during the twelve months ended September, 1940. An expenditure in the neighbourhood of £200,000 is also likely to be incurred on sub-stations.

During the past year the additional loan capital raised, mainly in order to finance extensions at the Hams Hall station and for distribution requirements consequent upon the expansion in supply, amounted to £1,213,000, of which £1,023,346 was spent. Capital redeemed during the year was £460,500. The total capital raised to date for the purposes of the undertaking is £19,114,288, of which £7,588,287 (equal to 39.70 per cent.) has been redeemed.

The revenue for the year was £3,199,787 and the trading expenditure amounted to £2,293,285 including £15,043 in respect of the cost of system and voltage change. The balance carried forward to net revenue account is £906,502 and miscellaneous credits have increased this to £929,880. After meeting capital charges, &c., the surplus on the year's working is £298,798, as compared with a surplus of £192,538 in the previous year.

Certain increased allowances for income tax purposes have been obtained with retrospective application, which cancelled the Department's liability to income tax during the present year. This amounted to a saving of £60,000 as compared with the previous year.

The increase in the cost of coal over the average price for 1935-36 resulted in an additional cost to the Department for the year under review of approximately £241,000.

From the credit balance of £298,798 carried forward from the net revenue account a debit balance of £12,009 carried forward from last year has to be met. The Committee has deemed it advisable to continue, so far as possible, to meet certain items of a quasi-capital nature from revenue, and is able to report that it has been unnecessary to utilise the sanctions which were given by the Council in February last, to capitalise the expenditure on meters and time-switches and hired apparatus. A sum of £186,124 has accordingly been utilised in meeting expenditure of a quasi-capital nature out of revenue, which leaves a credit balance of £100,665 to be carried forward to next year.

After crediting dividends and interest and deducting depreciation in the value of securities, the reserve fund amounts to £743,353, which is equivalent to 4.05 per cent. of the aggregate capital expenditure on the undertaking.

Further progress has been made during the year on the work of changing over from DC to AC and of increasing the voltage of supply of the e.h.v. transmission system. The cost of this work on consumers' premises, including new meters and service alterations, since a commencement was made seven years ago, has been £467,703. The whole of the expenditure up to March 31st, 1937, was liquidated as at that date and in the accounts now under review £15,043 has been charged. Standardisation of frequency has been continuously proceeding and £2,509,813 has now been spent on this work.

The quantity of electrical energy sold within the undertaking last year was approximately 815.5 million kWh, an increase of 37.3 million kWh, or 4.8 per cent., which is regarded as very satisfactory in view of the difficult period through which industry has been passing. In addition to these sales 219.0 million kWh was supplied to the C.E.B. (against 249.6 million kWh). The maximum supply demanded was 325,500 kW, compared with 322,000 kW in the previous year. It is interesting to note that the number of electric street lamps in use increased by nearly 2,000 to 14,185.

near Dhanbad, a coal mining centre, where water is available from the Damodar River. The ultimate output of the station will be 50,000 kW.

LARGE HYDRO-ELECTRIC PROJECT.—Two Provincial Governments—Orissa and Madras Presidency—contemplate undertaking jointly a large hydro-electric scheme utilising a waterfall at Bogra. The power available would be enough to meet the requirements of an extensive area. The project, which is estimated to cost Rs. 40 million, was first investigated by the Madras Government nearly seven years ago, when the district of Kuraput, now ceded to Orissa, was included in Madras Presidency.

PYKARA SCHEME.—Work on the second stage of the Pykara hydro-electric development scheme, begun early in 1937, is nearing completion, and one of the two new units will be brought into operation in a few weeks, while the second will be ready in about three months. The extension, including the Mukurti Dam, was necessitated by the large demand for power in the Tamil district due to rapid industrialisation.

Italy.—HYDRO-ELECTRIC SCHEME.—In a recent issue of *L'Energia Elettrica* details are given of the extensive hydro-electric developments at present being carried out in the Varaita Valley. The scheme embraces the construction of three power stations at Casteldelfino, Sampeyre and Brossasco. It is estimated that the three plants—the first two of which are expected to be completed before the end of the present year—will be able to produce 220 million kWh a year. The plant at the Casteldelfino station will comprise two 15,000 kW Francis-type turbines coupled to 17,500 kVA alternators working under a head of about 993ft. At both the Sampeyre and Brossasco stations two 18,000 kW sets are being installed.

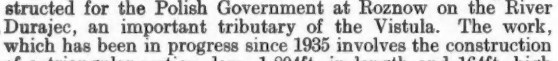
Norway.—GROWING POPULARITY OF ELECTRIC HEATING.—The outstanding experience of the electrical industry in Norway during the past year was a very marked increase in public interest in electrical cooking and heating apparatus. Several of the largest blocks of apartment houses in Oslo have been wired up for all-electric heating, and the use of such apparatus as well as all kinds of electrical kitchen appliances is being encouraged by the municipal power company, which is offering exceptionally low tariffs for such supplies.

Poland.—POWER PLANT IN DAM.—Particulars are given in a recent issue of the French journal *Arts et Métiers* of a large new hydro-electric power installation which is being constructed for the Polish Government at Roznow on the River Durajec, an important tributary of the Vistula. The work, which has been in progress since 1935 involves the construction of a triangular-section dam, 1,804ft. in length and 164ft. high at the centre. A feature of the installation is that the generating plant will be installed in a large chamber in the centre of the dam. There will be four Kaplan turbines of a total capacity of 50,000 kW coupled to 6,000 V generators. A transforming station is also to be established in the vicinity of the dam where the power will be stepped up to 150,000 V for long-distance transmission and to 30,000 V for nearer areas. The new station is expected to be completed during next year.

Russia.—NEW TURBO-GENERATOR.—A turbo-generator of 50,000 kW has been installed at the Dneprodzerzhinski power station, having been constructed by the Kharkov electro-mechanical works, learns *Reuter's Trade Service* from Moscow. It is hoped to have another turbo-generator of the same power ready at the end of the year.

TRACTION

Germany.—NEW ELECTRIC LOCOMOTIVE.—The A.E.G.'s 5,000th electric locomotive has just completed trials, and has been handed over to the Reichsbahn for operation on the



New German electric locomotive

line from Nuremberg to Saalfeld, which has recently been adapted for electric service. The new locomotive has an ordinary speed of 112 miles an hour. For special purposes it can be driven at 140 miles an hour. The use of this and similar locomotives will permit the reduction of the journey time between Berlin and Munich, when the line is fully electrified, from eight to five and a half hours. The engine has a rating of 5,800 kW, and the load which can be pulled uphill is given as 360 metric tons.

London.—TUBE EXTENSION.—On Monday last the extension of the Northern Line past Archway (Highgate) to East Finchley was brought into use. This is the first part of the £40,000,000 programme of the L.P.T.B. and L.N.E.R. and connects the

Completion of the inaugural run on the new tube line to East Finchley. In the picture are Lord Ashfield and Sir Ronald Matthews

former tube terminus with the L.N.E.R. The two tube tunnels pass underneath Highgate (L.N.E.R.) station, where a new station with escalator interchange facilities is being built, and come to the surface just south of East Finchley station, on each side of the L.N.E.R. tracks. The inauguration ceremony was performed last week when a train was driven from Leicester Square to East Finchley, the passengers including Lord Ashfield, chairman of the L.P.T.B. and Sir Ronald Matthews, chairman of the L.N.E.R. At East Finchley Sir Ronald spoke of the greatly increased facilities which the important link between the railway company and the London Transport tube lines would give to the travelling public.

A.R.P. and Public Service Mains

THE most recent of the series of handbooks produced by the Air Raid Precautions Department of the Home Office (No. 5) deals with the technical aspects of structural defence (Stationery Office, 2s.). In its 58 pages, which contain numerous diagrams and tables, it presents a great variety of information ranging from the characteristics of high explosives to the protection of windows against the effects of blast. The recommendations of the Fire Risks Investigation Committee, appointed by the Electricity Commissioners are endorsed.

Among other features of electrical interest is an account of the effects of an experimental bomb explosion on public service mains. A sample of road 40 ft. sq. was laid with 4-in. wood blocks on a 11-in. thick welded mesh concrete base over a 3-in. layer of ashes. Underneath the ashes was 3 ft. 6 in. of ballast and hard core and below this loamy soil. Gas and water mains were laid in two layers, the upper at right angles to the lower. The upper layer consisted of one 18-in. and one 6-in. cast-iron gas main and one 18-in. mild-steel water main and the lower layer consisted of three 18-in. cast-iron and two 18-in. mild-steel water mains. The telephone cables were of the lead-covered 50-core dry-paper insulated type, one laid in a 12-way octagonal duct in the way nearest the bomb and the other in a six-way spigot and socket duct. Three power cables for voltages from 3.3 to 66 kV were also laid.

The bomb was fired vertically with its nose buried 2½ ft. below the surface of the road, the space between the concrete and the bomb (about 4 in. all round) being filled with loose sand. The explosion made a hole 8 ft. in diameter in the road surface and scored out a cavern 20 ft. in diameter under the surface due to the disruption and subsequent removal of the ballast and hard core.

The depth of the crater was 4 ft. 3 in. and the concrete round it was raised above its normal level causing circumferential and tangential cracking. Fragments of concrete and some of the wood blocks were thrown 100 yd., others falling back into the crater. The water and gas mains and the telephone ducts in the top layer were shattered near the bomb site, but in the lower layer only the two mains nearest the bomb were destroyed, though the others were deformed. One of the telephone cables was broken, the other was damaged, but the power cables were practically unharmed.

Sequel to Kingston Fire

LAST week we reported that the London & Home Counties Joint Electricity Authority had issued a writ against the Central Electricity Board in respect of damage suffered by the Authority resulting from the fire at the Kingston generating station on December 14th. It was explained that the proceedings were being commenced to protect the Authority's interests. The *Surrey Advertiser* now reports that the Kingston Corporation has issued writs against the J.E.A., the C.E.B., and the General Electric Co., Ltd., claiming indemnity against all loss, damage, and expense to which the Corporation has been or will be put as a result of the fire.

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

Bridge Electrical Co., Ltd.—Private company. Registered June 29th. Capital, £750. Objects: To acquire the business of electrical fittings manufacturers and dealers, carried on by W. P. Bootman, S. C. Jones and P. W. Bootman at Oaklands Works, Oaklands Road, Cricklewood. Permanent directors: W. P. Bootman, 16, Appledore Close, Edgware, N.W., S. C. Jones, 570a, North Circular Road, N.W.2, and P. W. Bootman, 16, Appledore Close, Edgware, N.W. Registered office: Oaklands Works, Oaklands Road, Cricklewood, N.W.2.

Warner Engineering Equipment, Ltd.—Private company. Registered June 29th. Capital, £7,600. Objects: To carry on the business of manufacturers of and agents for the sale, purchase, exchange or hire of electrical and mechanical plant, machinery and accessories, &c. Permanent directors: W. A. Cuthbert, "Broadbridge," Compton, near Guildford (chairman), W. C. Warner, "Per Ardua," Rydes Hill, Guildford, and J. L. Browne, address not stated.

Stanley Holiday & Co., Ltd.—Private company. Registered June 29th. Capital, £100. Objects: To carry on the business of designers, manufacturers and suppliers of and dealers in electrical and allied equipment, apparatus, novelties, &c. Directors: R. H. Adams, 22, Porchester Square, W., and S. C. Holiday, 25, Onslow Gardens, Grange Park, N.21. Solicitors: Maxwell Batley & Co., 88, Leadenhall Street, E.C.3.

Attwater & Sons, Ltd.—Private company. Registered June 26th. Nominal capital, £63,000. Objects: To acquire the business of mica merchants, manufacturers of electrical and insulating materials, mill furnishers, and dealers in all descriptions of materials and goods used in the electrical, textile, boot, shoe and other similar trades, carried on by R. Attwater and five other members of the family at Hopwood Street and Polo Street Mills, and Riverside Works, Penwortham. R. Attwater, 31, Lower Bank Road, Fulwood, is permanent governing director, subject to holding 5,000 shares. Solicitors: Edelston, Son & Carter, 7, Winckley Street, Preston.

Harrisons (Sherwood), Ltd.—Private company. Registered June 28th. Capital, £500. Objects: To acquire the business of an electrical and radio engineer carried on by L. M. Harrison at 662, Mansfield Road, Nottingham. P. E. Cato, 200, Station Road, Mickleover, Derbyshire, is the first director.

Industrial Utilities (Birmingham), Ltd.—Private company. Registered June 26th. Capital, £100. Objects: To carry on at Birmingham and elsewhere the business of electricians, mechanical engineers, &c. P. N. Morrison, 102, The Hurst, Brook Lane, Birmingham, is first director. Solicitors: Duggan Elton & James, 43, Cannon Street, Birmingham, 2.

Burgess of Fareham, Ltd.—Private company. Registered July 1st. Capital, £5,000. Objects: To carry on the business of electrical, radio, aeronautical, mechanical and general engineers, general electrical installation contractors, manufacturers and repairers of and dealers in electrical equipment for motor vehicles, &c. A. B. Burgess, West Croft, Osborn Road, Fareham, Hants, is permanent managing director.

Technitools, Ltd.—Private company. Registered June 30th. Capital, £1,000. Objects: To carry on the business of manufacturers of press tools, jigs, gauges, measuring instruments, electrical instruments, radio components, &c. Subscribers: S. Wigzell, 25, Taylor Road, Wallington, Surrey; and D. D. Lear, 19, Cedar Road, Bromley, Kent. Secretary: A. A. Jeacock, 62, Brook Street, W.1.

T. N. Robinson, Ltd.—Private company. Registered June 30th. Capital, £5,000. Objects: To acquire the business of a wholesale electrical factor carried on by T. N. Robinson at 94-98, Daw Bank, Stockport. Permanent directors: T. N. Robinson and Mrs. M. Robinson, both of "Pinfold," Pinfold Lane, Romiley, Ches. Solicitors: Nicholls, Lindsell & Harris, Altrincham.

Companies' Returns

Statements of Capital

Bath Electric Tramways, Ltd.—Capital, £230,000 in 75,000 preference, 125,000 preferred ordinary and 30,000 deferred ordinary shares of £1. Return dated March 28th. All shares taken up. £200,000 paid. £30,000 considered as paid. Mortgages and charges, nil.

City of London Electric Lighting Co., Ltd.—Capital, £2,400,000 in 400,000 6 per cent. first preference, 300,000 8 per cent. second preference and 1,600,000 ordinary units of £1, £100,000 undenominated. Return dated March 29th. All units issued. £1,500,000 paid. £800,000 considered as paid. Mortgages and charges, £540,383.

Vickers, Ltd.—Capital, £26,500,000 in 23,684,516 ordinary shares of 10s., £6,157,742 ordinary stock, 136,193 preference shares of £1, £6,863,807 cumulative preference stock, £750,000 5 per cent. preference stock and £750,000 preferred 5 per cent. stock. Return dated April 17th. £6,157,742 ordinary stock, £6,863,807 cumulative preference stock, £750,000 5 per cent. preferred stock, and £750,000 preferred 5 per cent. stock taken up. £4,520,673 13s. 4d. paid. £10,000,875 6s. 8d. considered as paid. Mortgages and charges, £1,015,217 at 4 per cent.

Sunray, Ltd.—Capital, £2,000 in £1 shares. Return dated April 17th. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Anglo-Portuguese Telephone Co., Ltd.—Capital, £1,700,000 in £1,199,375 ordinary stock and 400,625 ordinary and 100,000 "A" ordinary shares of £1. Return dated April 19th. £1,199,375 ordinary stock and 100,000 "A" ordinary shares taken up. £10,788,223 9s. paid (including premiums of £77,369 9s.). £298,519 considered as paid. Mortgages and charges, £273,700.

Jarrow and District Electric Traction Co., Ltd.—Capital, £60,000 in £1 shares. Return dated April 27th. 59,934 shares taken up. £49,945 paid. £9,989 considered as paid. Mortgages and charges, nil.

Henley's (South Africa) Telegraph Works Co., Ltd.—Capital, £2,000 in £1 shares. Return dated April 28th. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Ilfracombe Electric Light & Power Co., Ltd.—Capital, £50,000 in £5 shares. Return dated May 1st. All shares taken up. £50,000 paid. Mortgages and charges, nil.

Cambridge Electric Supply Co., Ltd.—Capital, £600,000 in £1 shares. Return dated May 3rd. 500,000 shares taken up. £500,000 paid. Mortgages and charges, £30,000.

Caersws Electric Supply Co., Ltd.—Capital, £2,300 in £1 shares. Return dated April 11th. All shares taken up. £2,300 paid. Mortgages and charges, nil.

Edison Swan Cables, Ltd.—Capital, £150,000 in £1 shares. Return dated March 31st. All shares taken up. £150,000 paid. Mortgages and charges, £100,000.

W. Sanders & Co. (1915), Ltd.—Capital, £2,000 in £1 shares. Return dated April 5th. 2,000 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, £500.

Ericsson Telephones, Ltd.—Capital, £700,000 in 199,970 preference shares of £1 and 499,970 ordinary shares of 5s. and 1,500,150 ordinary stock units of 5s. Return dated April 12th. 199,970 preference and 1,500,150 ordinary stock units taken up. £269,980 paid. £305,027 10s. considered as paid. Mortgages and charges, £50,000.

Pritchett & Gold & E.P.S. Co., Ltd.—Capital, £200,000 in 100,000 preference and 100,000 ordinary shares of £1. Return dated April 19th. All shares taken up. £30,394 paid on 15,233 preference and 15,161 ordinary shares. £169,606 considered as paid on 84,767 preference and 84,839 ordinary shares. Mortgages and charges, nil.

Mortgages and Charges

Television Development (U.K.), Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated June 18th, 1939, to secure £4,000. Holder: J. S. Jennings, Whites Green, Horley, Surrey.

J. Houghton, Ltd.—Issue on June 19th of £500 debentures, part of a series already registered.

L. Norman Vivian, Ltd.—Issue on May 26th of £300 debentures, part of a series already registered.

Woodfyt Sales, Ltd.—Particulars filed of debentures, not exceeding £1,000, authorised June 12th, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Receiver Released

J. A. Burrows & Co., Ltd.—J. W. Grayston, of 10, Whitakers Buildings, New Victoria Street, Bradford, ceased to act as receiver on June 5th, 1939.

Increases of Capital

Kallay's Invisibility Rays, Ltd.—The nominal capital has been increased by the addition of £2,400 beyond the registered capital of £100. The additional capital is divided into 2,400 unclassified shares of £1 each. The directors are Edward S. Shrapnell-Smith, C.B.E. (director of Aldershot & District Traction Co., Ltd.), Arthur H. Johnson, O.B.E. (director of Ridgford Trust, Ltd.), Anton Van Beugen Bik (director of Ridgeford Trust, Ltd.), and Joseph Kallay.

Scophony, Ltd.—The nominal capital has been increased by the addition of £200,000 beyond the registered capital of £300,000. The additional capital is divided into 800,000 ordinary shares of 5s. each.

Welwyn Garden City Electricity Supply Co., Ltd.—The nominal capital has been increased by the addition of £75,000, beyond the registered capital of £75,000. The additional capital is divided into 50,000 7 per cent. cumulative preference shares of £1 and 500,000 ordinary shares of 1s. each.

Company Liquidations

Gloucestershire Electric Power Syndicate, Ltd.—Winding up voluntarily. Liquidators, Messrs. T. H. Underhill and E. H. G. Douse, 88, Kingsway, London, W.C.2.

Birmingham and Western District Tramways Co., Ltd.—Winding up voluntarily. Liquidators, Messrs. T. H. Underhill and E. H. G. Douse, 88, Kingsway, London, W.C.2.

Private Arrangement

B. W. Sprowell (B. W. Sprowell & Co.), electrician, Pwllheli.—The creditors met recently at Pwllheli when it was reported that the liabilities amounted to £363. After allowing £19 for preferential claims there were net assets of £206, leaving a deficiency of £158. It was stated that debtor commenced trading on his own account with little or no capital about eighteen years ago when he obtained a contract for about £3,000 for the electrical wiring of practically the whole of Pwllheli. During the next three years, however, the turnover only averaged £600 per annum, and recently it had been very small. In addition to the assets shown in the statement there was a lighting plant at his residence which he estimated should produce £40. It was

decided that he should be requested to execute a deed of assignment in favour of Mr. T. Griffiths, accountant, Pwllheli, as trustee.

Bankruptcy Proceedings

G. C. Pinney and **A. E. Miller** (Granby Service Co.), wireless and electrical dealers, 4, Granby Street, Littleport, Cambs.—The first meeting of creditors was held recently at the Official Receiver's Office, 41, Sidney Street, Cambridge. The joint statement of affairs showed gross liabilities of £1,055, of which £1,038 was expected to rank for dividend, with net assets of £369, leaving a deficiency of £670. The creditors passed a resolution for the appointment of Mr. F. E. Bendall, 4, Charterhouse Square, London, E.C.2, as trustee of the estate.

L. Jacobs (Loujay Radio), radio dealer, 162, High Street, Peckham, S.E.15.—Receiving order made June 27th on a creditor's petition. First meeting July 11th and public examination October 12th, both at Bankruptcy Buildings, Carey Street, London, W.C.2.

A. E. Townsend (trading as G. L. Townsend), radio dealer, 64, Phillips Street, Aston, Birmingham.—Receiving order made June 24th on debtor's own petition. First meeting July 10th at 37, Temple Street, Birmingham. Public examination July 19th at the Court House, Birmingham.

A. Hitner, electrical engineer and radio dealer, 7, Linden Grove, Fallowfield, Manchester.—Application for discharge to be heard on September 25th at the Court House, Manchester.

J. R. Johnston, electrical engineer, 13, Burnley Road, Padiham, Lancs.—Trustee, Mr. H. S. Haworth, 7, Lord Street West, Blackburn, Official Receiver, released June 21st.

A. W. Sadler, radio engineer and dealer, 115, Osmaston Road, Derby.—Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver, released June 28th.

G. A. Wood, electrical engineer (trading as A. G. Wood), 129, Bolton Road, Darwen.—Last day for receiving proofs for dividend July 15th. Trustee, Mr. H. S. Haworth, 7, Lord Street West, Blackburn, Official Receiver.

L. Cole (Netherfield Radio Stores), radio and electrical engineer, 5, Victoria Road, Netherfield, Notts.—Last day for receiving proofs for dividend July 15th. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

A. G. Field, radio dealer, 27, Station Road, Chadwell Heath, and at 22, Rowallan Parade, Dagenham.—First and final dividend of 1s. 3d. in the £, payable July 11th at 4, Charterhouse Square, London, E.C.1.

Reports and Dividends

General Electric Co., Ltd. — Speaking at the company's annual general meeting on June 29th, Lord Hirst, chairman and managing director, said that he was able once more to submit results beyond expectations. The electrical industry was in a state of evolution, and it was only due to the intense efforts of their research workers, engineers, staff and workers generally that new developments brought fresh results. The net profit of £1,776,000 was a new record. Home business had kept up remarkably well, and while they had benefited by Government orders, profits on these were not the extravagant figure that the public imagined. The actual output had been produced by nearly 40,000 workers, whose annual salary and wages amounted to £5,600,000.

Exports had exceeded last year's record figure, and were spread over nearly all their overseas markets, the British Empire absorbing over 80 per cent. Many foreign markets were closed by high tariffs and patent or trading agreements. Their principal customer was again South Africa, followed by Australia and India. All overseas branches had done well and nearly all had contributed to the company's profits, except China, and even there the figures had shown a great improvement.

The company was to-day forced to study carefully the starting of factories abroad if it did not wish to lose the footing it had obtained in Empire markets. In some cases where the Government had offered support to foreign countries, like Turkey, they had found a satisfactory opening for doing business. In this effort they were helped by the success which their research and development engineers had attained.

Fraser & Chalmers, their mechanical engineering works, continued with the successful construction of an ever-increasing number of turbines; seven 35,000-kVA, 3,000-RPM units were now going through the works. One of the most interesting factory contracts completed was the new strip mill of Richard Thomas & Co. at Ebbw Vale. The company's coal-washing, conveying and rolling mill plants continued to grow in favour. British manufacturers had reason to be proud of the fact that the designs of apparatus they had provided for the Central Electricity Board had stood the test of experience and it was acknowledged the world over that the British grid was unsurpassed; in this work the G.E.C. had played no unimportant rôle. Much work on the development of quicker-acting circuit-breakers had been done in their high-power test laboratory at Witton. They were at present installing transformers of 45,000-kW capacity and were holding their own in the overseas transformer market.

A self-contained works had been built at Witton for making mercury-arc rectifier equipments. They had had a spectacular success with their pumpless air-cooled rectifier, which had, they considered, for most purposes rendered all other types of rectifiers obsolete. Large contracts had been obtained from the L.P.T.B., the L.N.E.R., and for installations as far apart as Perth (Western Australia), Buenos Aires, Copenhagen and Spitzbergen. In railway electrification they had obtained important work both for the London Underground Railway and the Manchester-Sheffield line. Electrical equipment for trolley-buses had been sent to all parts of the world, and they had reason to be proud of their success in the electrical equipment of ships. Their telephone works had been engaged to its full capacity, and the largest and most important of Australia's automatic exchanges, Melbourne City West, had just been completed. In the installation of 12-channel telephone carrier circuits the company was playing an important part.

A comprehensive range of ultra-high frequency radio transmitters had been brought on to the market, and their pioneer researches into the generation of very short radio waves were bearing fruit. The radio industry generally seemed to have adjusted itself to a lower volume of business, but competition within the industry continued to depress prices. The Government's recent decision to encourage the distribution of broadcast programmes by wire to subscribers' houses might intensify competition from both private relay companies and from the Post Office. The effect of this on the industry would require to be carefully watched. The public was now realising that television was no longer an experiment but an established factor in everyday life, and he hoped that the lead which this country obtained by being first in the field would be maintained by the energetic extension of television to the provinces.

They were constantly endeavouring to improve the quality of their lamps, and the study of mercury lamps and of fluorescent materials had formed the subject of very energetic investigation by their research workers. Business in general lighting and domestic commodities had been somewhat affected by the crisis.

With regard to subsidiary and associated companies the chairman first referred to the Electric Development and Securities Trust, which controlled various supply companies. The output of electricity from these showed an increase of 17 per cent. over the previous year, while the number of consumers connected rose by 12 per cent. He suggested that the progress shown demonstrated that the supply industry might well be left in the hands that at present administered it.

The Express Lift Co. had been satisfactorily occupied, while Chamberlain & Hookham, Ltd., the Pirelli-General Cable Works, and the M.O. Valve Co. still maintained their leading positions. The Salford electrical instrument works had been considerably enlarged during the past year owing to an ever-increasing demand for their products, and their X-ray business, Watson & Sons, had held its position in spite of severe competition. The Siemens & General Electric Railway Signal Co. had achieved a record in the value of orders received, and Claude General Neon Lights, Ltd., had risen to be the leading company in the electric sign world.

In a survey of industrial conditions, Lord Hirst said that the future depended on their power to adapt themselves to changed and changing conditions in their business and industrial lives. Having referred to the way in which world trade was hampered by import restrictions, he said that for the moment he could only hope that this country had still the men, the scientists and engineers who were capable of creating as yet unknown commodities that the world would require. If they succeeded in that they might force some of the doors open again that were at present locked. They must also take full advantage of opportunities to strengthen trade within the Empire. Given that there was not going to be an international flare-up, he was optimistic that they could look with confidence to the future, provided their costs of production were not unduly further burdened by unreasonable demands on industry.

The Young Accumulator Co., Ltd., held its annual meeting on July 3rd, when Lt.-Col. L. P. Winby (chairman), who presided, said that generally speaking the increase in their figures represented their greater activities during the year under review. That improved condition had continued into the present year and sales during the first three months of the current financial year had been considerably greater than in any previous similar period. Their turnover again showed a useful increase, which was fairly general and not due to rearmament demands. There should be a future demand for emergency batteries for lighting and power for A.R.P. It had become increasingly evident that further factory space was required to cope with the needs of the general business, and plans had been prepared for an extension to the works and laboratory. It was hoped that these extensions would be completed by the autumn in time to take advantage of them for the busy winter season.

With regard to the electric vehicle business in which they were interested, all types of vehicles manufactured by A. E. Morrison & Co. & Electricars, Ltd., had been standardised and substantially improved. The turnover of those companies had been maintained notwithstanding the drop in sales of all commercial vehicles during the past year. As to the prospects of their own business for the coming year, if the improvement in sales was maintained, and the country left in peace, shareholders might look forward to a further substantial improvement in the results for the current year.

Thomas de la Rue & Co., Ltd.—Speaking at the annual general meeting last week Mr. B. C. Westall, vice-chairman and managing director, stated that with regard to their plastic business they had a layout, plant and equipment second to none in Europe, if not the world. Although they were one of the oldest companies in the industry, they had made it their business to ensure that their plant was continually brought up to date. They were now putting in a press which was the largest in the country and they would be in a position to manufacture mouldings of a size no other firm in the country could produce.

The Brazilian Traction Light & Power Co., Ltd.—Mr. Miller Lash, president of the company, stated at the annual general meeting held last week in Toronto that although during 1938 there was some slowing up in the general conditions in Brazil, business there continued active and statistics in the annual report showed a progressive improvement during that year in the company's services which was continuing in 1939.

The Madras Electric Supply Corporation, Ltd., has announced that an arrangement has now been concluded with the Government of Madras whereby a new tariff was introduced as from June 1st. Including the cost of the new electricity tax to be borne by the Corporation, it is estimated that this will result in a reduction in revenue of £22,000 for 1939 and £32,500 for a full year, the tariff to remain unaltered for the next four

years. It is hoped, with the gradual expansion of the business, that it will be possible to maintain a reduced dividend of 6 per cent., free of tax, on the ordinary shares for the next four years.

Wessex Electricity Co.—The *Financial Times* reports that underwriters have been called upon to take up about 90 per cent. of the offer for sale at 96 of £1,500,000 3¾ per cent. debenture stock.

Broadcast Relay Service.—The lists in connection with the issue of 200,000 £1 5½ per cent. redeemable cumulative preference shares were closed on Friday morning last, being over-subscribed.

A. C. Cossor, Ltd., report a net trading profit of £81,260, to which is added £6,618 from interest and dividends, making £87,878. After providing for directors' fees (£1,982), staff pensions (£3,467), income tax (£22,612) and N.D.C. (£3,928), there was a net profit of £55,889. Preference dividends take £23,925, and an ordinary dividend of 6 per cent. £21,750, leaving £10,214 to be carried forward.

The report states that owing to the unforeseen difficulties of Ismay Industries, Ltd., the considerable business expected from that company did not materialise and the advantages of the association were not as anticipated. Sterling Batteries (a subsidiary) incurred a loss of £3,000, but in view of negotiations taking place the directors have not considered it necessary to make any provision for the loss in present accounts.

The Jerusalem Electric & Public Service Corporation proposes to pay a dividend of 7 per cent. (same) on the ordinary shares.

Hall Telephone Accessories, Ltd., are to pay an interim dividend of 5 per cent. (same).

The Nico Light Co., Ltd., reports a net loss of £1,651 for the year ended March 31st, as compared with a net profit of £4,057 in the preceding year. Deducting the deficit from £2,679 brought forward, there remains £1,029 to be carried forward. Last year £2,000 was placed to reserve and a dividend of 6¼ per cent. was paid.

The Traction & General Investment Trust is to maintain its interim dividend at 4 per cent.

British Insulated Cables, Ltd., has given notice of its intention to redeem on January 4th, 1940, the whole of the outstanding 5 per cent. debenture stock at £103 per cent.

The Bristol Tramways & Carriage Co., Ltd., has announced an interim ordinary dividend of 4 per cent., tax free (against 4 per cent., less tax).

The Telephone Manufacturing Co., Ltd., has placed privately 100,000 5s. shares, increasing its issued capital to £385,000.

The Aldershot and District Traction Co., Ltd.—The directors recommend a dividend of 8 per cent. on the ordinary shares.

Bennis Combustion, Ltd., reports a net profit for the past year of £25,968, as compared with £24,907 in the preceding year. It is proposed to pay a final dividend of 5 per cent., less tax, making 10 per cent. for the year (same).

The Telegraph Construction & Maintenance Co., Ltd., has declared an interim dividend of 5 per cent. (same).

Richardsons, Westgarth & Co. propose to pay an ordinary dividend of 7½ per cent. for the year ended March 31st (against nil).

The Great Northern Telegraph Co. has declared an interim dividend of 2½ per cent. (same).

The Great Northern Telegraph Co.'s Holding Co., Ltd., proposes to distribute for the year ended June 30th a total dividend of 23½ per cent. or 12.69 Danish kr. per share of 54 kr., to set aside 457,000 kr. for taxes and to carry forward 5,487 kr. The corresponding figures for the year 1937/38 were as follows:—Total dividend 23½ per cent.; set aside for taxes, 532,000 kr.; balance carried forward 5,306 kr.

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 28th.

Dudley Electric (lettering and design), No. 605496. Class 7 (IV). Drying, hairdressing, polishing, washing and wringing machines, all being electrically operated, and electric motors (not for vehicles). No. 605497. Class 8 (IV). Electric shaving instruments. No. 605499. Class 11 (IV). Electric heating lighting, steam generating, cooking, refrigerating, drying and ventilating apparatus, appliances and installations. No. 605511. Class 21 (IV). Attachments for vacuum cleaners for dusting, polishing, blowing and spraying. Co-operative Wholesale Society, Ltd., 1, Balloon St., Manchester.

Sterilamp. No. 605785. Class 10 (IV). Lamps for producing ultra-violet rays for surgical or curative purposes or for use in relation to the health of men or animals. Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., U.S.A. (British representative, G. Raymond Shepherd, 2, Norfolk Street, Strand, W.C.2.).

Theravic. No. 607014. Class 10 (IV). Surgical or medical instruments, apparatus and appliances. Metropolitan-Vickers Electrical Co., Ltd., 1, Kingsway, London, W.C.2.

Electricity in the United States

Papers at Edison Institute Convention

IN stating "The Case for Central Station Power" at the recent annual convention of the Edison Electric Institute in New York, Mr. H. M. Sawyer put the total sales of electricity from public undertakings in the United States at 11,770 million kWh in 1912 and 93,894 million in 1938, the corresponding gross revenue figures being $313 million and $2,168 million. Mr. Sawyer expressed the opinion that the healthy progress made by public supply was due largely to the competition of private plants. He referred to the views expressed by a vice-president of General Motors Corporation, which has extended its scope to include the manufacture of stationary Diesels, to the effect that where electric power was available from central stations at a reasonable rate there would be little demand for Diesel installations.

The purchaser of electricity could place his works most suitably in regard to markets, raw materials and labour without having to consider such questions as fuel and water; he did not tie up capital in fixed assets, an excessive tendency towards which was the chief cause of business failure; nor would he be affected by vagaries in oil prices and probable future taxes.

By investing in a private plant he pegged his investment at a point not likely to be reached again, since engine efficiencies and performance were best at the time of installation and declined during each year of operation; also the introduction of improved designs reduced the value of his own plant as an asset. The actual economic life of an isolated plant was almost always less than its useful physical life and changes in the location of industry could not be predicted. For these reasons the larger industrial concerns wrote off capital invested in private plant in two or three years. On the other hand, the cost of public supply was constantly being reduced.

A successful form of propaganda by the American Gas and Electric Co., New York, was a booklet consisting of photographs of consumers' installations before and after taking public supply with captions describing the original prime mover, reasons for replacement and a brief description of the electrical substitute.

A paper relating to electric power in war time was presented by General C. Keller. Without including New England and the Pacific Coast, there was a shortage of power in the United States in 1918 of 325,000 kW, which would have reached 500,000 kW in 1919 had the war continued. Much of the power required, however, was for munitions for the Allies, including the United States themselves. The author considers that in any future war it would be sufficient to complete, in time of peace, detailed designs of generating units of agreed size, together with accurate bills of material and schedules of delivery dates that had been co-ordinated with other requirements of a war programme.

Approximately one-quarter (31.8 million) of the population of the United States were living on 6.8 million farms in 1935, but agriculture accounted for only 15 per cent. of the national income. In a survey of "Progress in Rural Land Building," Mr. H. E. Dexter said that mechanisation of the farm, as the introduction of the motor car showed, called for a reorganisation of methods. It was the automatic feature of electricity which was new to the farmer, enabling him to carry out for extended periods of time many operations that called for no attendance.

There were now 1,410,000 electrified farms which took 2,520 million kWh per annum or 2.7 per cent. of the total sales for all purposes. Of these farms 350,000 in the irrigation areas used on an average 4,356 kWh each per annum at 1.9 cents, while those elsewhere used 1,045 kWh at 4.5 cents. Electric service was now available to one quarter of American farms.

There was a tendency for the individual farmer to do more processing before sale, *e.g.*, to sort fruit immediately after picking or to prevent gluts by putting it into cold storage. As the rural market was limited by ability to pay for equipment, the best line of approach was to supplant present sources of energy rather than to sell electricity on the basis of an improved standard of living. Every rural dweller needed hot water, a little refrigeration and some cooking which could be done by electricity, but not even easy terms or rental arrangements would permit the great mass of low-income consumers to do these operations on any large scale. For a very low income consumer a roaster-broiler-type burner combination, a kettle and a refrigerator sufficed, followed by a 1½-gal. non-pressure water heater as income increased.

By such means the kWh sold to farms in the area of the Central Hudson Corporation increased by 13 per cent. last year, giving an average of 1,769 kWh per consumer at 3.71 cents as against the national average (in non-irrigation areas) of 1,045 kWh at 4.5 cents. The revenue per farm, however, was $65.7 compared with the national figure of $47. Some of the best salesmen for dealing with low-income consumers were well-trained ex-linesmen, who knew how the people lived and responded to new ideas.

STOCKS AND SHARES

TUESDAY EVENING.

THE constantly repeated statement that we "cannot go on like this for much longer," is beginning to lose its force by reason of its reiteration and the fact that we do, nevertheless, continue to carry on. The suspense makes itself evident nowhere more plainly than in Stock Exchange markets, where energies are becoming slack for want of exercise and where the general disposition of prices is to dwindle to lower levels.

The satisfactory nature of the unemployment figures goes for little in such times as these. Gilt-edged prices have been overcast by a fiasco which followed the launching of a £7½ millions London County issue at 96½, of which the public subscribed for less than 6 per cent. This had a damping effect upon investment markets as a whole, including those within which the electrical and construction companies' shares are comprised. Nevertheless, the newly issued North Metropolitan Power Station 3½ per cent. second mortgage debenture stock, offered at 91½, has remained steady at 10s. discount. The unconfirmed news that an Anglo-Soviet pact would shortly be signed, brought about a sharp revulsion of feeling round the Stock Exchange markets and led to a general rise in the majority of the popular issues, investment and speculation alike.

London Transport

No great store is set by the fact that London Transport Board receipts have fallen moderately—in comparison with last year—since the higher fares came into operation. Weather and politics, rather than the higher cost, are deemed to have been the chief deterrents to travel. Nevertheless, it seems possible that the fact has had something to do with this week's fall of 5 points, to 74½, in the price of the "C" stock.

Greater interest is shown in the results of the full year's working just ended. Traffic receipts for the fifty-two weeks have risen by £347,000 to £29,736,000, before pooling with the main-line companies. Allowing for a possible decrease, on the one hand, in working expenses, and for an increase, on the other, in payment of interest on capital works, the expectation is for another payment making 4 per cent. for the year. It will then remain to be seen how near the increase in fares will bring the stockholders to their standard 5½ per cent. dividend.

Electricity Supply and A.P.D.

Although details of the new Armament Profits Duty had caused scarcely a passing qualm in the market for electricity supply shares, interested parties are glad to have an official ruling on the subject. The Minister was asked to give an assurance that the phrase "armament business" or "armament contract," as applied to work coming within the scope of the duty, did not cover the supply of electricity and certain other services.

Exemption was claimed for these, not in order to avoid national obligations, but on the ground that the companies were not in a position to make the excess profits which it was the purpose of the clause to tax. Answer came to the effect that the undertakings in question were never intended to come within the scope of the duty. If necessary, it appears, a specific assurance will be given in the Finance Bill. Generally speaking, electricity supply shares have been holding their prices well. Among the few changes this week are declines in Northmet Power, at 42s. 6d., Midland Counties, at 36s. 3d., and County of Londons at 42s. 6d.

North Metropolitan Power

At the time of the issue, North Metropolitan Power Station new 3½ per cent. second debenture stock looked good for a premium over the offered price of 91½. In the event, however, a small discount appeared in the first dealings. Stock can consequently be bought in the market, free of stamp, at about the prospectus price, which gives a running yield of £3 16s. 6d. per cent. and a return of just over 4 per cent. to redemption in 1965. Judged either by the security, or by comparison with other issues of the same standing, the return is considered by many people to be too generous to remain for long, when once the bulk of the new stock has come to rest in firm hands.

By way of comparison, it is noted that such issues as London Power 3½ per cent. debentures, at 95½, free of stamp, yield £3 16s. 3d. per cent. to redemption in 1972; and Electrical Distribution of Yorkshire 3½ per cent. stock, at 92, £3 14s. 9d. per cent. allowing for repayment in 1965.

Wessex Debenture

Subscription lists for the offer of £1,500,000 Wessex Electricity 3½ per cent. debenture stock opened on the last nervous day of last week. Applications from the public came to about £150,000. The underwriters were left with 90 per cent. of the stock, and the quotation opened at 1½ discount. At the present quotation of the discount, the yield comes to £4 per cent., without allowing for capital profit on redemption. Repayment will take place at 100 in 1959, or, at the company's option, at any time after 1954. Redemption terms on these lines are a concession to the chariness of capital towards a long interval to the due repayment date. According to the prospectus, interest on the debentures is covered three times by the average of recent profits, and the amount of stock three times by assets. The share capital is owned by Edmundsons Corporation.

Brazilian Traction

From the point of view of dividends, hope deferred is still the lot of Brazilian Traction stockholders. Satisfaction with the progress of the undertaking, as reviewed at the annual meeting held a week ago in Canada, remains somewhat hollow in the absence of facilities for transferring profits out of the country. No material change in the currency situation has taken place since the intimation, six months ago, that no funds were being received from Brazil for the payment of dividends.

Meanwhile, the stockholders have the chairman's reassurance that their position is constantly in mind, and that payments will be resumed as soon as is practicable. Brazilian overseas trade is the key to the currency situation. A favourable trade balance will enable the Government to release more money for export. The price of the shares has relapsed ¾ to 8⅞, under pressure of apprehension that the international complexities may lead to sales of these shares by Belgian holders. Brazilian Tractions are a favourite speculative counter in Brussels.

General Electric Meeting

Lord Hirst's speech at the General Electric Company's meeting took his hearers through almost every section of both the electrical and the geographical worlds. The review leaves an impression of the great breadth of the foundations on which the business is built. This aspect, together with the no less impressive character of the balance sheet, helps to explain why the shares rank among the aristocrats of the industrial markets.

After falling 1s. this week to 74s. 6d., the price of the shares stands some 7s. 6d. below the best point of of the year. The yield of 5⅛ per cent. is below the average return on industrial shares, calculated at present to be in the neighbourhood of 5.6 per cent. Speaking of the future, Lord Hirst showed himself as no subscriber to the theory that slump and boom must inevitably follow one another. Subject to the political risk, and provided that industry is not unreasonably burdened, he takes a confident view of the outlook.

Broadcast Relay Issue

Dealings began this week in the new shares issued by Broadcast Relay Services. The 5s. ordinary (2s. 6d. paid), offered at 6s., are changing hands around 5s. 6d., and the £1 5½ per cent. redeemable preference (10s. paid) at 8s. 9d. The prospectus showed average net profits, over the past three years, of £41,300, a sum equal to five times the preference dividend requirements, and to earnings of 9 per cent. on the ordinary capital. On the face of things this indicates a moderate return on the ordinary shares at the present price; but account is to be taken of the new scope for expansion since the extension of the operating licence for a further ten years. Also, the Postmaster-General, in introducing the new Post Office wireless scheme, expressed his anxiety to see the relay services rapidly developed. Part of the proceeds of this issue will be used as fresh working capital, and the new money will doubtless be put to profitable use. At 18s. 9d., the preference shares give a return of £5 17s. 4d. per cent. on the money. They can be paid off at any time between 1942 and 1959.

The over-subscription of the offer says much, under the circumstances, for the practical character of the interest which has lately revived in the business.

Miscellaneous Matters

Sensitive as usual to changes in the international atmosphere, the prices of communication stocks have continued to yield ground. Cable and Wireless ordinary stock has fallen to 49½, bringing the yield again to 8 per cent.; the preference is a point down at 88½. Globe Telegraph issues have been steady since the meeting, but Great Northerns have given way from 30½ to 29. In the transatlantic group, American "Tel. and Tel.," at 170½ have lost and subsequently recovered 3 points. Internationals are down ¼, to 7; Western Unions remain at 20½.

Among transport stocks, another set of good railway traffic figures failed to support the market. Southern preferred, which has lately aroused a good deal of speculative attention, was lowered from 72 to 69½. Bristol Trams improved 1/6 to 48s. 3d. on the declaration of a 4 per cent. tax-free interim dividend. Last year's interim payment was 4 per cent. less tax.

Electrical equipment shares have given a tolerably satisfactory account of themselves during the uneasiness of the past week. The few material price changes have been mainly among the cable manufacturing shares, Callenders at 61s. 3d., Johnson & Phillips at 38s. 9d. Enfields at 50s. 9d., and British Insulated at 77s. 6d., all being lower.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 High-est	1939 Low-est	Dividend Pre-vious	Dividend Last	Price July 4	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole ...	68/3	63/9	15	15	63/9	—	4 14 4
British Power and Light ...	30/9	26/–	7	7	28/6	—	4 18 3
City of London	33/9	31/–	7½	7½	31/–	–6d.	4 16 9
Clyde Valley	37/9	34/–	8	8	37/–	—	4 6 6
County of London ...	46/9	41/9	10½	10½	42/6	–1/6	4 18 10
Edmundson's :							
7% Pref....	31/6	30/–	7	7	30/6	—	4 11 10
Ord.	27/9	23/–	9	6	25/9	—	4 13 2
Elec. Dis. Yorkshire ...	41/6	37/9	9	9	38/9	—	4 12 9
Elec. Fin. and Securities ...	47/9	45/–	12½	12½	47/6	—	5 5 3
Elec. Supply Corporation...	51/9	48/–	12	12	49/–	—	4 18 0
Isle of Thanet	20/–	18/6	4	4	18/6	—	4 6 6
Lancs Light and Power ...	34/6	29/–	7½	7½	30/9	—	4 17 7
Llanelly Elec.	22/6	21/–	5½	5½	21/–	—	5 4 9
Lond. Assoc. Electric ...	29/3	26/3	7	7	26/3	—	5 6 8
London Electric	34/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red...	106½	102½	5	5	104	—	4 16 2
Metropolitan	51/–	45/3	12	12	47/6	—	5 1 0
Midland Counties	38/9	34/–	8	8	36/3	–¼	4 8 3
Mid. Elec. Power	41/9	38/3	8	9	38/9	—	4 13 0
Newcastle Elec.	28/9	26/6	7	7	27/–	—	5 3 8
North Eastern Electric :							
Ordinary...	32/3	28/6	7	7	30/6	–6d.	4 11 10
7% Pref....	32/6	30/–	7	7	31/6	—	4 9 0
Northampton	48/–	45/–	10	10	47/6	—	4 4 2
Notting Hill 6% Pref. (£10)	13¼	13	6	6	12¾	—	4 14 1
Northmet Power :							
Ordinary...	46/6	41/6	10	10	42/6	–2/–	4 14 0
6% Pref....	29/–	27/6	6	6	27/6	—	4 7 3
Richmond Elec.	29/–	27,3	7	7	27/6	—	5 1 10
Scottish Power	38/9	33/9	8	8	36/3	—	4 8 2
Southern Areas	22/9	19/6	4½	5	20/6	—	4 17 7
South London	30/9	28/–	7	7	28/–	—	5 0 0
West Devon	23/3	22/6	5	5	22/6	—	4 9 0
West Glos.	21/3	18/–	2	2½	18/6	—	2 14 1
Yorkshire Elec.	38/6	34/9	8	8	37/–	—	4 6 6
Overseas Electricity Companies							
Atlas Elec.	4/3	2/–	Nil	Nil	2/6	–3d.	—
Calcutta Elec.	39/–	29/6	10*	10*	29/6	–1/–	—
Cawnpore Elec.	34/6	28/3	10	10	28/3	—	7 1 7
East African Power ...	26/3	22/6	7	7	24/–xd.	+6d.	5 16 8
Jerusalem Elec.	24/6	23/3	5	[6	24/–xd.	+1/–	5 0 0
Kalgoorlie (10/–)	10/6	9/6	7½	7	10/3	—	7 6 4
Madras	31/–	25/–	8*	8*	25/–	–¼	—
Montreal Power	34½	31	1½	1½	33xd.	–1	—
Palestine Elec. "A" ...	29/6	26/3	7½*	7½*	23/9	—	6 6 4
Perak Hydro-electric ...	18/9	15/–	7	6	15/9	—	7 12 4
Shawinigan Power ...	23½	20	85cts.	83cts.	20½	–¾	—
Tokyo Elec. 6%	61	50	6	6	48½	—	12 7 6
Victoria Falls Power ...	72/–	60/–	12½	15	68/9	—	4 7 3
Whitehall Investments Pref.	19/6	16/–	7½	7½	19/–	—	7 17 0
Public Boards							
Central Electricity :							
1950–70	112	106	5	5	110	—	4 11 0
1955–75	115½	108	5	5	110	—	4 11 0
1951–73	106½	103½	4½	4½	104½	—	4 6 2
1963–93	95½	86	3½	3½	91½	—	3 16 6
London Elec. Trans, Gtd.	88½	84	2½	2½	5½xd.	—	2 18 6
London & Home Counties							
1955–75	107½	105	4½	4½	105xd.	—	4 5 9
Lond. Passenger Transport :							
A	114½	104⅝	4½	4½	104½	–1	4 6 4
B	117½	105	5	5	107½	–1	4 13 0
C	83½	[64½	4½	4	74½	–5	5 7 5
West Midland Joint Elec.,							
1948–68	112½	109	5	5	108½	—	4 12 2
Telegraph and Telephone							
American Tel. & Tel. ...	180	159	9	9	170½	—	5 5 5
Anglo-Am. Tel. :							
Pref.	101½	89½	6	6	94½	–1	6 7 0
Def.	23⅜	19	1½	1½	23	—	6 10 4
Anglo-Portuguese	24/–	19/9	8	8	20/–	—	8 0 0
Cable & Wireless :							
5½% Pref.	95½	75	4½	5½	88½	–1	6 4 4
Ord.	55	34	4	4	49½	–1	8 1 8
Income	100	95½	—	—	98	—	4 1 8
Canadian Marconi $1 ...	5/6	3/9	—	Nil	4/3	–1/–	—
Globe Tel. & Tel. :							
Ord.	31/3	23/6	7½*	7½*	30/–	—	5 0 0
Pref.	26/9	23/3	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)	38	27½	20	20	29xd.	–1½	6 18 0
Inter. Tel. & Tel.	10½	7½	Nil	Nil	7	–½	—
Marconi-Marine	30/–	23/–	7½	10	28/9	—	6 19 4
Oriental Telephone Ord. ...	2½	46/3	12*	12*	2 7/16	—	4 16 0
Radio Corpn.	8⅛	6	8	6	6½	–⅛	—
Telephone Props.	14/–	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/–) ...	10/–	8/6	6	6	9/6	—	3 3 2
Western Union	25½	19½	2¾	—	20½	—	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref. (£5)	7/6	3/6	Nil	Nil	6/3	—	—
4% Inc.	16	7	Nil	Nil	13	—	—
British Electric Traction :							
Def. Ord.	1025	700	5	5	800	–50	—
Pref. Ord.	164	158	8	8	155	—	5 3 3
Bristol Trams	48/6	37/3	8	10	48/3	+⅛	4 3 2
Brazil Traction	13	7⅞	$1	50c.	8¼	–¾	—
Calcutta Trams	25/6	23/6	8	8	22/–	—	7 5 6
Cape Elec. Trams....	18/–	16/9	5	6	17/6	—	6 17 2
Lancs Transport	36/6	32/6	10	10	35/–	—	5 14 3
Mexican Light :							
1st Bonds	25	21	5	5	25	—	—
Rio 5% Bonds	81	47	5	5	75	—	6 13 4
Southern Rly :							
5% Prefd.	75½	48	5	5	69½	–2½	7 4 0
5% Pref....	90½	80	5	5	94½	—	5 5 9
T. Tilling	48/3	39/6	10	10	45/–	—	4 9 7
Tilling & B.A.	53/–	50/–	10	9*	52/6	—	3 8 7
West Riding	37/9	31/3	10	10	36/3	—	—
Equipment and Manufacturing							
Aron Electricity Ord. ...	32/3	28/9	15	15	28/9	—	10 8 8
Assoc. Elec. :							
Ord.	45/3	34/9	10	10	39/–	—	5 2 7
Pref.	36/6	34/–	8	8	35/–	—	4 11 5
Automatic Telephone & El.	46/6	39/3	10	12½	46/3	–⅛	5 8 3
Babcock & Wilcox ...	42/9	37/–	10	12½	43/9	–9d.	5 14 4
British Aluminium Ord. ...	58/3	48/9	12½	12½	53/9	–½	4 13 0
British Insulated Ord. ...	88/–	77/–	20	20	77/6	–⅛	5 3 0
British Thermostat (5/–) ...	16/–	12/–	18½	18½	13/3	–6d.	6 19 7
British Vacuum Cleaner (5/–)	22/6	18/6	40	40	15/–	—	—
Brush Ord.	5/9	4/6	Nil	Nil	5/3	—	—
Callender's	92/–	67/6	20	15	61/3	–⅛	4 18 0
Chloride Elec. Storage ...	82/3	65/–	20	15	3½	—	4 12 4
Consolidated Signal ...	96/–	80/9	36½	36½	82/6	–⅛	8 16 9
Crabtree (10/–)	25/6	21/6	17½	17½	23/9	—	7 7 4
Crompton Parkinson :							
Ord. (5/–)	21/–	14/9	12½	15	17/6	–⅛	—
E. K. Cole (5/–)	9/–	4/–	10	Nil	4/6	—	—
Elec. & Musical Industries (10/–)	14/9	8/9	10	5	9/6	–3d.	5 5 3
Electric Construction ...	38/6	30/6	12½	13½	37/6	—	7 4 0
Enfield Cable Ord. ...	58/6	2½	25	16½	50/–	–3/9	6 10 0
Electrical Switchgear (10/–)	27/–	23/9	16	16	23/9	—	6 14 9
English Electric	36/–	30/3	10	10	34/6	—	5 16 1
Ensign Lamps (5/–) ...	14/6	13/9	—	25	14/6	—	8 12 6
Ericsson Tel. (5/–) ...	43/–	35/–	25*	25*	41/3	—	3 0 6
Ever Ready (5/–)	24/–	18/6	35	30	18/6	–1/–	8 2 2
Falk Stadelmann	27/–	21/–	10	10	22/6	—	8 18 0
Ferranti Pref.	25/6	23/6	7	7	22/6	—	6 4 5
G.E.C. :							
Pref.	31/9	29/3	6½	6½	31/3	—	4 3 2
Ord.	82/–	70/9	17½	20	74/6	–1/–	5 7 6
Greenwood & Batley ...	27/6	24/6	7	15	26/3xd.	—	11 9 0
Hall Telephone (10/–) ...	22/3	19/3	15	15	20/–xd.	—	7 10 0
Henley's (50/–)	21/–	17/9	20	20	18/9	—	5 6 8
4½% Pref. ...	23/–	21/6	4½	4½	22/6	—	4 0 0
Hopkinsons	46/3	37/3	12½	15	43/9	—	6 17 0
India-Rubber Pref. ...	21/–	20/–	5½	5½	21/3	—	5 3 6
Intl. Combustion	120/–	97/–	32½	32½	5 11/16xd.	–2/6	5 14 5
J. Lucas	60/–	52/–	15	15	56/3	–⅛	5 6 9
Johnson & Phillips ...	41/3	32/–	12½	12½	38/9	–⅛	6 9 0
Lancashire Dynamo ...	68/–	60/–	25	25	62/6	—	8 0 0
Laurence Scott (5/–) ...	12/–	10/–	15	15	10/6	—	7 2 10
London Elec. Wire ...	31/6	29/–	12	7½	28/9	—	5 4 4
Mather & Platt	50/–	42/6	13½	13½	47/–	—	5 15 0
Metropolitan Elec. Cable Pf.	21/3	21/–	5½	5½	21/3	—	5 3 6
Murex	85/9	63/9	20	20	73/9	–⅛	5 8 8
Pye Deferred (5/–) ...	13/9	7/6	25	25	9/6	—	13 3 2
Revo (10/–)	35/6	29/–	17½	17½	29/–	—	6 0 8
Reyrolle	61/–	52/6	12½	12½	56/3	—	4 9 0
Siemens Ord.	26/9	20/6	7½	7½	23/9	—	6 6 4
Strand Elec. (5/–) ...	5/6	4/9	5	10	4/6	—	11 2 0
S. Smith (1/–)	9/9	6/–	37½	50	7/6	–⅛	6 13 4
Switchgear & Cowans (5/–)	15/–	11/3	20	20	12/–	–6d.	8 6 8
Telegraph Condenser (10/–)	7/6	5/–	5	—	7/6	—	—
Telegraph Construction ...	2½	37/6	10	10	37/6	—	5 6 8
Telephone Mfg. (5/–) ...	10/–	8/–	9	9	9/–	–6d.	5 0 0
Tube Investments... ...	91/–	82/9	23¾	23¾	87/6	—	5 9 7
Vactric (5/–)	4/3	2/3	10	4	2/3	—	8 18 0
Vickers (10/–)	24/6	19/–	10	10	18/3	–3d.	5 9 7
Westinghouse Brake ...	54/9	43/9	17½	17½	48/9	—	7 3 5
Walsall Conduits (4/–) ...	31/9	24/–	55	55	27/–	—	8 3 0
West, Allen (5/–)	7/6	5/9	7½	10	6/9	—	7 8 2

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

23960. "Apparatus for the production, amplification, or reception of ultra-high-frequency oscillations." O. Borman. September 10th, 1936. (506881.)

24017. "Electrical communication systems." Telephone Manufacturing Co., Ltd., L. H. Paddle, and J. G. Flint. September 2nd, 1937. (506865.)

24018. "Electrical communication systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. September 2nd, 1937. (Cognate applications 2389/38 and 15595/38.) (506909.)

24107. "Combined electric starting and current-generating installation for internal-combustion engines." Scintilla, Ltd. September 4th, 1936. (507005.)

24234. "Electrical treatment of water for the purpose of preventing the formation of scale." W. A. Beatty. September 4th, 1937. (507052.)

24373. "Current-interrupting arrangements, in particular for periodically recurring switching operations in arc-discharge convertors." Siemens-Schuckertwerke Akt.-Ges. September 8th, 1936. (506922.)

24706. "Impulse electric motors." A. A. Thornton. (S. Ruben.) September 10th, 1937. (507140.)

29085. "Fluorescent screen arrangement particularly for television purposes." F. Ring. October 26th, 1936. (506911.)

30397. "Electrically-heated thermostatically-controlled ovens." General Electric Co., Ltd., and O. W. Humphreys. November 5th, 1937. (507141.)

30965. "Electrical condensers." A. H. Hunt and J. H. Fisher. November 11th. 1937. (507143.)

33371. "Electric-discharge rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. December 2nd, 1937. (506997.)

33420. "Television transmitting systems." J. D. McGee, and H. G. Lubszynski. December 3rd, 1937. (507059.)

33555. "Combined apparatus for television reception and film projection." Kolster-Brandes, Ltd., and C. N. Smyth. December 3rd, 1937. (507144.)

33561. "Air-space insulated electric cables." Norddeutsche Kabelwerke Akt.-Ges. February 10th, 1937. (507201.)

33615. "Method of producing an apparent leakage from mosaic elements, more particularly for picture-transmitting arrangements." F. Stumpf, and F. Ring. December 4th, 1937. (Convention date not granted.) (506998.)

33705. "Electric signalling systems." Westinghouse Brake & Signal Co., Ltd., August 31st, 1937. (506918.)

33712. "Electric circuits for operating electric-discharge devices from an alternating-current supply." General Electric Co., Ltd., M. Pirani and R. Rudenburg. December 6th, 1937. (506919.)

33715. "Apparatus and method for the determination of the dielectric constant of finely divided solid substances." Haardt & Co., Akt.-Ges. December 9th, 1936. (506921.)

33719. "Control arrangements for vapour electric-discharge convertors." British Thomson-Houston Co., Ltd., and J. C. Read. December 6th, 1937. (506923.)

33720. "Electric transformers." British Thomson-Houston Co., Ltd., and B. Withers. December 6th, 1937. (506924.)

33722. "Manufacture of cast resinous articles containing metal or other inserts." British Thomson-Houston Co., Ltd., December 5th, 1936. (507000.)

33737. "Electrical signalling systems." Automatic Telephone & Electric Co., Ltd., and W. Saville. December 6th, 1937. (506927.)

33838. "Electric cables having refractory pulverulent insulation." Solution Trust, Ltd. December 7th, 1936. (507007.)

33844. "Television receiving apparatus." Scophony, Ltd., and F. Okolicsanyi. December 7th, 1937. (507146.)

33860. "Lighting fittings." General Electric Co., Ltd., and G. S. Robinson. December 7th, 1937. (Addition to 445388.) (507010.)

33995. "Construction of electron-discharge devices." C. S. Bull, and H. E. Holman. December 8th, 1937. (507209.)

34099. "Device for periodically modifying current flow in an electric circuit." A. H. Stevens. (K. E. Schimkus.) December 9th, 1937. (507154.)

34129. "Charge-assessing means in connection with electricity or like meters." Sangamo Weston, Ltd., and G. E. Weston. December 9th, 1937. (507214.)

34138. "Electrodes or welding-rods for use in welding." Sure-Arc Electrode Co., Ltd., and F. W. Calow. December 9th, 1937. (507159.)

34166. "Wave-filters." British Thomson-Houston Co., Ltd. December 9th, 1936. (507216.)

34213. "Alloys, particularly for resistance wire for electric fires, heaters and the like." British Driver-Harris Co., Ltd., and W. M. Kay. December 10th, 1937. (Cognate application 30930/38.) (507167.)

34262. "Telephone or like exchange systems." Standard Telephones & Cables, Ltd. January 14th, 1937. (507174.)

34278. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. December 11th, 1936. (507176.)

34311. "Electrical condensers." Marconi's Wireless Telegraph Co., Ltd., and D. A. Bell. December 10th, 1937. (507179.)

34312. "Frequency changing high-frequency electrical circuits." Marconi's Wireless Telegraph Co., Ltd., and O. E. Keall. December 10th, 1937. (507180.)

34313. "Modulated carrier frequency circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and O. E. Keall. December 10th, 1937. (507220.)

34314. "Direction-finding radio receivers." Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright December 10th, 1937. (507181.)

34334. "Mounting of electrical accessories on walls and similar surfaces." J. A. Crabtree & Co., Ltd., and H. F. McLoughlin, and B. G. Harrison. December 11th, 1937. (507182.)

34347. "Microphones for modulating large currents." G. R. Fountain and A. E. C. Snell. December 11th, 1937. (507183.)

34413. "Thermionic amplifiers." R. E. Spencer. December 13th, 1937. (507077.)

34746. "Vapour electric discharge apparatus." General Electric Co., Ltd., and E. Gallizia. December 15th, 1937. (507078.)

35837. "Contact mechanism of electric tumbler switches." J. H. Tucker & Co., Ltd., and F. C. Fuke. December 28th, 1937. (Cognate application 35838/37.) (506838.)

35863. "Electron beam discharge tubes." Ferranti, Ltd., and M. K. Taylor. December 28th, 1937. (506933.)

1938

104. "Multi-stage thermionic amplifiers." General Electric Co., Ltd., and L. I. Farren. January 3rd, 1938. (506840.)

422. "Electrical test circuits for use, for instance, in automatic telephone systems." Standard Telephones & Cables, Ltd. January 12th, 1937. (507192.)

1512. "Electron-discharge devices." Hazletine Corporation. February 2nd, 1937. (507021.)

2318. "Photo-electric arrangements for positioning articles to be printed in multi-colour." F. Shurley and Q. H. Shurley. February 8th, 1937. (507089.)

4228. "Bearings for electric switches, circuit-breakers, and the like." C. Weydemeyer, A. Kress and M. Zander. February 10th, 1937. (507096.)

4457. "Electrical communication systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. February 12th, 1938. (507100.)

4597. "Insulating material for electric conductors and process for its manufacture." Kabelwerk Vacha Akt.-Ges. February 13th, 1937. (Cognate application 4598/38 and 4599/38.) (506855.)

5053. "Television and like receiving systems." Ferranti, Ltd., and H. Wood. February 18th, 1938. (506856.)

6053. "High-tension electric circuit-breakers." C. H. Flurscheim, G. W. Davidson, and Metropolitan-Vickers Electrical Co., Ltd. February 25th, 1938. (506857.)

6497. "Devices for suppressing electrical interference." General Electric Co., Ltd., and A. Warrington. March 2nd, 1938. (507108.)

7971. "Electric cables." Soc. Italiana Pirelli. March 15th, 1937. (506944.)

9173. "Thermionic amplifiers." General Electric Co., Ltd., E. C. Cherry and G. W. Edwards. March 25th, 1938. (Cognate application 35168/38.) (506946.)

9493. "Electric cables." Callender's Cable and Construction Co., Ltd., and J. Taylor. March 28th, 1938. (506948.)

11207. "Receiving arrangements for electric remote-control systems." Landis & Gyr Akt.-Ges. June 21st, 1937. (506951.)

13825. "Partition walls particularly for accumulators, electric batteries and the like." J. Grabec and A. Von Ledofsky. May 9th, 1938. (507117.)

15089. "Time-controlled devices applicable to electric switches and valves." B. G. Horstmann and Horstmann Gear Co., Ltd. May 20th, 1938. (506960.)

15615. "Thermionic valves." M-O Valve Co., Ltd., and W. H. Aldous. May 25th, 1938. (507119.)

17064. "Automatic frequency control circuits for radio receivers." British Thomson-Houston Co., Ltd. June 8th, 1937. (506876.)

17228. "Television and like electric systems." P. M. G. Toulon. June 15th, 1937. (Addition to 497367.) (506877.)

17713. "Compressed powder magnetisable cores." Siemens & Halske Akt.-Ges. June 14th, 1937. (506878.)

18627. "Cathodes for photo-electric cells." Electric Research Products, Inc. June 26th, 1937. (507122.)

23603. "Radio systems." C. Lorenz Akt.-Ges. August 10th, 1937. (506977.)

24691. "Circuit arrangement for supplying a saw-tooth current to a load-impedance." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 25th, 1937. (507129.)

25363. "Induction furnaces." M. Tama. November 1st, 1937. (506980.)

27290. "Radio receivers comprising means for suppressing disturbances of short duration." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 21st, 1937. (506987.)

28293. "Machine for the washing of clothes and like purposes." D. K. Fairweather (Soc. L'Electricité Mors). September 29th, 1938. (506989.)

28368. "Electric motors." Reda Pump Co. September 30th, 1937. (507032.)

29107. "Process for manufacturing paste electrolyte for accumulators." M. Hartmann. October 7th, 1938. (507035.)

29699. "Electric welding apparatus." Messerschmitt Akt.-Ges. October 13th, 1937. (506886.)

32035. "Telegraph exchange system." Standard Telephones & Cables, Ltd. December 16th, 1937. (507132.)

35051. "Electrical socket connectors." National Co., Inc. December 8th, 1937. (507133.)

35163. "Telephone systems." C. Lorenz Akt.-Ges. December 3rd, 1937. (507048.)

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5636. "Method of making an electri-discharge tube comprising a secondary-emission electrode." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 22nd, 1938. (507054.)

6204. "Machines for covering electric cables." H. G. C. Fairweather (Compagnie Générale d'Electricité). February 24th, 1939. (Addition to 493835.) (507055.)

15139. "Apparatus for stroboscopic illumination." Scophony, Ltd., and F. Okolicsanyi. December 7th, 1937. (Divided out of 507146.) (507199.)

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Argentina.—BUENOS AIRES.—July 24th. National Sanitation Works Department. Eleven transformers. (T. 23602/39.)*

July 25th. Six electric pumping sets and accessory plant for deep well service. (T.Y. 24156/39.)*

July 31st. Two electric pumping sets. (T.Y. 24157/39.)*

Australia.—MELBOURNE.—August 2nd. Victorian Railway Commissioners. Battery charging equipment. (T. 23332/39.)*

August 8th. Posts and Telegraph Department. Gas-filled, arrestor-type cable terminal boxes. (T. 23947/1939.)*

August 1st. Automatic voltage regulators. (T. 24377/39.)*

August 22nd. Switchboard cords. (T. 24376/39.)*

August 22nd. Condensers and interference suppression units. (T. 24375/39.)*

October 3rd. State Electricity Commission of Victoria. AC network analyser. (June 23rd.)

Beckenham.—July 24th. Borough Council. 800/1,200 tons of coal. (See this issue.)

Single-phase and three-phase house service type meters. (June 23rd.)

Blackpool.—July 24th. Borough Council. Stores and materials for twelve months. (See this issue.)

Caithness.—July 21st. Territorial Association. Electrical and heating work at new headquarters at Thurso for the 226th Anti-Aircraft Battery, R.A. (T.A.). Colonel H. F. Baillie, secretary, Caithness County Territorial Association, 57, Church Street, Inverness (deposit £2 2s.).

Carlisle.—City Council. Electrical installation in new cubicle block at the Infectious Diseases Hospital. Plans by P. Dalton, city engineer, 18, Fisher Street.

Cheadle and Gatley.—July 17th. Electricity Department. One 500-kVA oil-cooled transformer. (June 30th.)

Chester-le-Street.—R.D.C. Electrical installations in 256 houses at Sacriston, including wash boilers. Plans by M. Wilson, surveyor, Union Offices.

Coventry.—July 8th. Electricity Department. One ferro-concrete cooling tower and pond and one brick-built chimney. (June 23rd.)

Derby.—July 8th. Electricity Department. Electrical control equipment for domestic apparatus. (June 23rd.)

Dundee.—July 11th. Harbour Trust. Electrical work at new Customs Waterguard Offices. General manager and engineer, Harbour Chambers.

Dunfermline.—July 14th. Town Council. Electric lighting installations in twenty-two houses at Townhill. Town Clerk (deposit £1).

Egypt.—CAIRO.—July 20th. Municipalities Department. Power plant, including Diesel engines and accessories, alternator and exciter, switchgear, pumping sets, travelling crane and tackle and armoured cables, at Minia power station. (T. 23867/1939.)*

July 26th. Electrical apparatus and armoured cables for supply at Sohag. (T. 23866/1939.)*

Exeter.—July 20th. Electricity Department. Three-phase transformers. (See this issue.)

Farnworth.—July 14th. Electricity Department. Low-voltage cables. (June 30th.)

Fife.—July 8th. County Council. Heating and electrical installations at new clinic at Dunfermline and new infant department, Leslie H. G. School. County Clerk, Cupar (deposit £1 1s.).

Halifax.—July 10th. Housing Committee. Electrical work in fifteen houses and shops at Nursery Lane. P. Saunders, Town Clerk, Town Hall.

Horsham.—July 10th. Electricity Department. Cables. (June 30th.)

Huddersfield. — July 7th. Estate Department. Reconstruction of lift at George Hotel, necessitated by change-over from DC to AC. (June 23rd.)

Ilford.—July 8th. Electricity Department. 6.6-kV metal-clad switchgear. (June 30th.)

India. — SIMLA.—July 18th. Indian Stores Department. Sub-station equipment at New Delhi railway station. (T. 24145/39.)*

July 13th. Switchboard and alternator and feeder panels, synchronising apparatus, interconnection cables and spares. (T. 24144/39.)*

July 13th. Sub-station equipment, together with 300-kVA alternator, low-voltage distribution board, AC motors and starters, cable and wall-type terminal boxes. (T. 23862/1939.)*

July 13th. Electrodes for twelve months. (T. 24073/39.)*

September 5th. Inert and dry cells and sac elements for twelve months. (T. 23861/39.)*

Keighley.—July 17th. Electricity Department. High-voltage overhead line between Dimples quarry and Bankfield quarry. (See this issue.)

Kettering.—July 12th. Borough Council. Forty-eight street lamps. (June 30th.)

Lanark. — County Council. Electric street lighting installations. (June 30th.)

Liverpool.—Electric Supply Department. Twenty-four 1,250-kVA, twenty-four 1,000-kVA and twelve 250-kVA step-down transformers. (See this issue.)

London.—BETHNAL GREEN.—July 7th. Electricity Department. One 500-kVA transformer. (June 23rd.)

ST. PANCRAS.—July 11th. Electricity Department. Cables, meter boards, stoves, fires, washboilers and water heaters for twelve months. (June 23rd.)

H.M. OFFICE OF WORKS.—July 21st. Electric wiring in boiler houses at Bridgend R.O.F. (See this issue.)

ISLINGTON.—August 2nd. Borough Council. Electric wires, lampholders, switches, conduits, &c. (See this issue.)

Longbenton.—U.D.C. Electric lighting installations in 106 houses on the Dudley estate. Plans by H. G. McNaught, surveyor, Council Offices, Forest Hall.

Middlesbrough.—July 14th. Electricity Department. 660-V and 11,000-V p.i., lead-covered cables for twelve months, 11,000-V circuit-breakers and 250-kVA transformers. (June 30th.)

Newark-on-Trent.—July 24th. Electricity Department. 1,400-yd. of 0.06 sq. in. cable, 11-kV metal-clad ring main unit, 500-kVA transformer and low-voltage sub-station switchboard. (June 30th.)

Newcastle-upon-Tyne. — July 20th. Transport and Electricity Committee. New positive plates in the main traction battery at Manors. (See this issue.)

Newport. — July 24th. Corporation. Electrical installation at St. Julian's secondary school. (See this issue.)

New Zealand. — WELLINGTON. — July 18th. Public Works Department. Pumps, motors, mountings, piping, valves and control gear for the R.N.Z.A.F. station, Ohakea. (T. 23784/39.)*

August 15th. Time relays and test terminals. (T. 23781/39.)*

August 29th. Contactor panels and push-button boxes. (T. 23782/39.)*

September 12th. 6.6-kV outdoor switchgear and steelwork. (T. 23791/39.)*

September 12th. Seven single-phase transformer banks. (T. 23833/39.)*

September 19th. Two 3,000-kVA, 11-kV, three-phase transformers and control equipment. (T. 23792/39.)*

September 19th. Seven single-phase double-wound transformer units. (T. 23793/1939.)*

September 12th. Four single-phase transformer units. (T. 24278/39.)*

September 19th. Transformer bank for Hamilton sub-station. (T. 24279/39.)*

September 19th. 50-kV outdoor switchgear and steelwork. (T. 24282/39.)*

September 19th. 110-kV outdoor switchgear and steelwork. (T. 24274/39.)*

September 26th. Three single-phase transformer units for Huntley sub-station. (T. 24280/39.)*

September 26th. Transformer banks for Belmont sub-station. (T. 24277/1939.)*

October 3rd. 110-kV and 50-kV air-break and oil-immersed switchgear and accessories. (T. 24281/1939.)*

August 24th. Posts and Telegraph Department. 500-lb. of insulating tape. (T. 24066/39.)*

CHRISTCHURCH.—July 31st. Electricity Department. Six sets of sub-station switchgear. (T. 24165/1939.)*

Rhyl.—July 17th. Electricity Department. Extra-high-voltage cable and switchgear and transformers. (June 23rd.)

Rothesay.—July 12th. Harbour Commissioners. Electrical work at buildings on new pier. Schedules from M. Purdon Smith, architect, 33, Castle Street, Dumfries.

Salford.—July 11th. Electricity Department. P.i. lead-covered cables for three years. (June 23rd.)

Sheffield.—July 31st. Electricity Department. Electrically operated travelling crane at Blackburn Meadows generating station. (June 30th.)

July 15th. Lighting installation, &c., at Abbeydale girls' secondary school. W. G. Davies, city architect, Town Hall (deposit £2).

Shildon.—U.D.C. Accepted. Street lighting system with mercury vapour lamps.—North-Eastern Electric Supply Co.

South Africa.—PRETORIA.—July 20th. Union Tender and Supplies Board. Thirty magneto telephone switchboards. (T. 23513/39.)*

July 20th. Two 100-kVA transformers. (T. 23675/39.)*

August 3rd. Floor pattern magneto switchboards. (T. 23676/39.)*

August 3rd. One 25-cell battery. (T. 23983/39.)*

CAPE TOWN.—July 19th. Electricity Supply Commission. One 380-V switchboard and two transformers. (T. 23952/39.)*

July 26th. Electricity Department. Eight single-phase, double-wound transformer units. (T. 23798/39.)*

CAPE TOWN.—July 26th. Electricity Supply Commission. High- and low-voltage cable and pilot cable. (T. 24342/1939.)*

JOHANNESBURG.—July 12th. City Council. House service electricity meters. (T. 24219/39.)*

Extra-high-voltage and low-voltage p.i. power cable and combined pilot and telephone cable. (T. 24218/39.)*

South Shields.—Town Council. Electrical installations at thirty-four houses in Wenlock Road. Plans by the borough engineer, Town Hall.

Stockport.—July 17th. Electricity Department. 200 street lamp standards and brackets with lanterns, chokes and condensers. (See this issue.)

Stone.—July 18th. Electricity Department. Extra-high-voltage and low-voltage cables at the new Garden Village, Barlaston. (June 30th.)

Wakefield.—July 17th. Electrical installation at Bingley school and institute. Education Officer, County Hall.

Orders Placed

Birkenhead.—Education Committee. Accepted. Electrical installation at Conway Street school (£409).—J. Heaney & Co.

Eccles.—Electricity Committee. Accepted. 11-panel switchboard (£1.707) and 5-panel board (£899).—Met.-Vick. Electrical Co. Meters for twelve months: Prepayment.—British Electric Meters. House service type.—Met.-Vick. Elecl. Co.

Liverpool.—Electric Power and Lighting Committee. Accepted. High- and low-voltage switchgear for two years for the equipment of static sub-stations.—Ferguson, Pailin; Crompton Parkinson; Switchgear & Cowans; Met.-Vick. Elecl. Co. One six-panel neutral earthing

switchboard for Lister Drive power station (£575).—Switchgear & Cowans.

Accepted. Plant required in connection with the proposed change-over from 6,000 V to 11,000 V: Six 5,000-kVA transformers for Lister Drive power station (£15,000).—G.E.C. One 5,000-kVA transformer for Aintree sub-station (£1,550).—Electric Construction Co. Two 25,000-kVA transformers for Paradise Street sub-station (£18,000).—Met.-Vick. Electrical Co. Two 15,000-kVA transformers for Garston sub-station (£10,480) and two 15,000-kVA transformers for Lark Lane sub-station (£10,480).—Yorkshire Electric Transformer Co. Two 33,000-V circuit-breakers for Paradise Street sub-station (£4,714).—Met.-Vick. Electrical Co. Two 33,000-V oil-immersed isolating switches for Lark Lane sub-station (£496).—A. Reyrolle & Co.

London. — ST. PANCRAS. — Electricity Committee. Recommended. Fifty street lanterns.—Siemens Electric Lamps and Supplies.

STOKE NEWINGTON.—Electricity Committee. Accepted. One 500-V motor-generator (£50).—Electro Dynamic Construction Co. Supplying and carrying out alterations to plant and switchgear (£1,344).—G.E.C.

Middlesex.—Buildings Committee. Accepted. Internal telephone installation at Willesden local offices (£462).—Reliance Telephone.

Estates Committee. Accepted. Electrical installation at Holly Hill Farm, Enfield (£223).—Middlesex Electrical Co.

Salford.—Electricity Committee. Recommended. Reblading turbo-alternator at Agecroft power station (£4,804).—Met.-Vick. Electrical Co.

Tynemouth.—Town Council. Accepted. Two transformers (£173 and £202).—C. A. Parsons & Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Additions to factory, Enfield Road, W.3, for Hommade, Ltd.; P. Pratt and Blount, architects, 174, High Road, W.3. Extensions to factory for Acton Bolt & Fine Threads, Ltd., Chase Road.

Adwick-le-Street.—Council offices, Village Street (£16,000), for U.D.C.; Shapley & Davison, architects, 22, Queen Square, Leeds.

Aldershot.—School (£64,358), for the E.C.

Amble (NORTHUMBERLAND). — Houses (50); Hetherington and Wilson, architects, County Chambers, Newcastle-on-Tyne.

Anglesey.—Holiday camp, &c., Cymyran, for North Wales Estates, Ltd.; Roberts, Wood and Elder, architects, 2b, King Street, Manchester.

Baillieston.—Houses (96), Garrowhill Garden estate; H. Boot (Garden Estates), Ltd.

Barnstaple.—Houses (48), Tresise's Field, Derby Road, for T.C.; borough surveyor, The Castle.

Bexley. — Municipal buildings (£140,000), for T.C.; borough surveyor, Council Offices, Broadway, Bexley Heath.

Bingley.—Houses (24), Gilstead estate; E. O. Robinson, surveyor and architect, Town Hall.

Birmingham.—Houses, Lea Hall estate; Morris, Jacombs & Sons, Ltd. Bus depot, Quinton (£105,000); city engineer. Depot and offices, Walsall Road, Perry Barr, for Albion Motors, Ltd., 98, Livery Street, Birmingham; William Wilkinson, Ltd., builders, 92, Hutton Road, Birmingham. Factory and office buildings, Moseley Street; G. Linnegor & Son, builders. Newtown Row, Birmingham. Flats (216), Spring Hill; city engineer. Extensions to Erdington institution (£27,847); Parsons & Morrin, Ltd. Extensions to works, for Fillerys Toffees, Ltd., Warwick Road, Greet; W. & J. Evans, Ltd., contractors, 295, Highgate Road.

Blackpool.—Offices, Park Road, for the Fylde Water Board, Sefton Street; C. Button, architect, Bank Chambers, King Street, Farnworth, near Bolton.

Blyth.—Houses (284), North Farm estate; borough engineer.

Bradford.—Houses (270), Westfield Gardens estate; J. A. Fletcher, city architect, Town Hall. School, Parkside Road; R.C. authorities.

Brierley Hill.—Houses (150), Birch Tree Coppice site; R. H. J. Coomber, U.D.C. surveyor.

Brighton.—Houses (28), Nelson Street and Carlton Street, for T.C.; borough surveyor, Town Hall.

Bromham.—Extensions (£20,000), to Bromham House Colony, for Beds. and Northants Joint Board for the Mentally Defective; C. Whitwell & Son, architects, 3, Newhall Street, Birmingham.

Bromley.—Houses (275), Hayes Place estate; Tysoe & Harris, Ltd., 81, High Street.

Cardiff.—Magnesium works, Colchester Avenue, for International Alloys, Ltd.

Chester-le-Street.—New offices (£19,500); R.D.C. surveyor.

Coventry.—Houses (44), Crecy Road and Woodstock Road; A. E. Gilks, builder, Lythalls Lane. School, Alderman's Green Road (£25,000); Blue Coat School trustees.

Dagenham.—Central depot, Rainham Road, for B.C.; F. J. Clevely & Partner, architects, 47, Gordon Square, London, W.C.1.

Darlaston.—Factory for aircraft components, Willenhall Road; Rubery, Owen & Co., engineers, Booth Street.

Durham.—School building programme for the County E.C. (£448,000); county architect, 34, Old Elvet, Durham.

Ealing.—Dwellings (58), Islip Manor Road; Chelmick Bros., builders, Islip Manor Road. Extensions to works, for Edmore Pattern works, Osterley Park View Road.

Easington (Co. DURHAM). — Houses (127); G. McCall, builder, New Hetherington.

Eire.—(SOUTH CORK).—Houses (375), on various sites, for Board of Public Health; J. Hurley, secretary, Board Room, Douglas Road, Cork.

Essex.—Schools, Loughton Valley Hill, and Blacksmiths Lane, South Hornchurch, for C.C.; county architect, County Hall, Chelmsford.

Finchley.—Children's home, Gordon Road; St. Giles Christian Mission. Development of Elmshurst estate; Comben & Wakeling, Ltd., 603, Kenton Road, Kenton.

Gateshead.—Houses (136), for the North Eastern Housing Association, Ltd., Newcastle-on-Tyne; F. H. Patterson, borough engineer, Town Hall, Gateshead.

Great Barr.—Shops and flats, Walsall Road, for Haycock & Inchley, Court Chambers, Lombard Street, West Bromwich.

Hanwell.—Community centre (£6,290); E. Plaistowe & Sons, Ltd.

Harrow.—School, Porlock Avenue (£59,469); Jones & Sons.

Harrogate.—Houses (75), Grove House estate; borough engineer.

Hartlepool.—Houses (117), Middlegate area, for the North-Eastern Housing Association; J. H. Miers, architect, Town Hall, Hartlepool.

Haydock.—Houses (108), Waggon Lane estate; U.D.C. surveyor.

Hemsworth. — Houses (200), near Station Road; A. Wright, U.D.C. surveyor.

Hornchurch.—Development of Lee Gardens estate; Anns & Haigh, architects, 58, Grosvenor Street, London, W.1.

Hull.—Factory buildings, on site on the river front, for R. Silcock & Son, Ltd., Liverpool.

Inverness-shire.—R.C. school (£13,000) for County Council; architect, County Council, Inverness.

Isleworth.—Extensions to works, Worton Road; C. & S. Construction Co., Ltd.

Kendal.—Houses (324), for the T.C.; N. Bell and Co., builders, Leeds.

Kettering.—Offices, flat and houses, Queensberry Road and Station Road, for Britannic Assurance Co., Ltd.

Kirbymoorside (YORKSHIRE).—Houses (33); R. P. Brotton & Son, architects, Chopgate, Stokesley.

Lancashire.—Schools, Aintree, Atherton, Netherton and Skelmersdale, for the County E.C.; S. Wilkinson, county architect, County Offices, Preston.

Leeds.—Ten-storey building, on an island site, The Headrow; Sir Henry Price.

Lincoln.—Maisonettes (40 blocks), for Super Homes (Wolverhampton), Ltd. (£50,000); L. W. Barnard & Partners, architects, 13, Imperial Square, Cheltenham.

Liverpool.—Factories (£36,250); city engineer.

London.—(BERMONDSEY).—Flats, Maze Pond, and six shops, Staples Rents area (£60,828); borough engineer. Extensions to factory, 77-91, Grange Walk; L. Kennard, 14, Railway Approach, London Bridge, S.E.1. (FINSBURY PARK).—Factory, Vale Road, N.4, for Wilson, Warden & Co., Ltd.; W. Eve & Sons, architects, 10, Union Court, Old Broad Street, E.C.2.

Maghull.—Cinema and shops, Alt Park estate; A. E. Shennan, architect, North House, North John Street, Liverpool.

Maryport.—Factory, Solway Trading estate, for West Cumberland Development Co., Ltd.

Newburn.—Houses (90), Walbattle estate; U.D.C. surveyor.

Newcastle-on-Tyne.—Houses (40), in flats, Silver Lonnen, for D. Gateshill; F. M. Dryden, architect, New Market Street. Twelve flats, the Fossway; Northern Housing Development, Ltd., builders, Huddleston Road, Newcastle-on-Tyne. School, Stamfordham Road; F. Harvey, Education Offices, Northumberland Road.

Peterborough. — Houses (62), Park Lane estate, for T.C.; A. J. Reeves, town clerk, Town Hall.

Romford.—Houses (250), Rise Park; R. J. Carter, builder, "Priests," Havering Road, Romford.

Romford.—Central fire and ambulance station, for T.C.; borough surveyor.

St. Ives.—Town hall and municipal offices, for T.C.; W. Rainey-Edwards, town clerk, Municipal Buildings.

Scunthorpe.—Maisonettes (53 blocks), Warwick Road, for Melville & Webber; W. N. Cook, architect, 7, St. Mary's Street, Bridgnorth.

Shenley (MIDDLESEX).—Isolation accommodation, mental colony (£6,400); county architect.

South Shields.—Extensions to the Town Hall (£20,000); Henderson Bros., contractors, Smith Street, Tyne Dock.

Stourport.—Houses (60), off Bewdley Road North; H. Matthews.

Sutton Coldfield.—Fire station (£30,500); borough engineer. Schools, Holland Road (£50,000), with electrical work; education architect.

Thornaby-on-Tees. — Extensions to Town Hall; P. Brown, borough engineer.

Tottenham.—Community centre, Philip Lane (£8,799); A. Monk, Lower Edmonton Road, N.9.

Tynemouth.—Houses (22), West Chirton estate; F. R. N. Haswell & Son. Forty-four flats, West Chirton estate; J. Dixon, builder, 33, Lynn Road, North Shields. Cleansing and decontamination depot for T.C.; borough engineer.

Urmston.—Houses (24), off Ullswater Road, Davyhulme; J. Maunders & Sons, Ltd., 85, Derbyshire Lane, Stretford.

Walsall.—Cinema and shops, Broadway, Walsall, for W. S. Clift, 5, Union Street, Birmingham; E. S. Roberts, architect, Lombard House, Great Charles Street, Birmingham.

Wantage.—Houses (141), for R.D.C.; F. A. Shorey, clerk, Council Offices, Belmont, Wantage.

Ware.—Houses (43), Vineyard estate, off Musley Lane, for U.D.C.; R. W. Grantham, architect, The Priory, Ware.

Wembley.—Houses (81), Slough Lane; Bunting Construction Co., Ltd., 49, Baker Street, London, W.1. Flats (66), Forty Avenue, Bucks and Middlesex Estates, Ltd.

Wednesbury.—Houses (18), Brunswick Park estate; E. Smith & Sons, 27, Birmingham Road, West Bromwich. Houses (52), Golf Link estate; G. W. Yates, Holdon Road, Wednesbury. Houses (40), Red House Ground; H. Dare & Son, Ward End, Birmingham. Shops and warehouses, near High Street, for the Walsall Co-operative Society, Ltd., Walsall; architects' department (C.W.S.), 1, Balloon Street, Manchester.

West Bromwich.—Shops and flats, Walsall Road, Stone Cross; Kingham & Co., architects, 339, High Street, West Bromwich.

Willesden.—Drill hall and headquarters, North Circular Road, for Middlesex Territorial Army and A.F.A.; Healey & Mackenzie, architects, 29, St. George Street, Hanover Square, W.1.

Wisbech.—Houses (21), Money Bank; Cockett Fruit Farms, Ltd.

York.—Houses (68), Regent Street clearance area, for T.C.; C. J. Minter, city engineer, Guildhall.